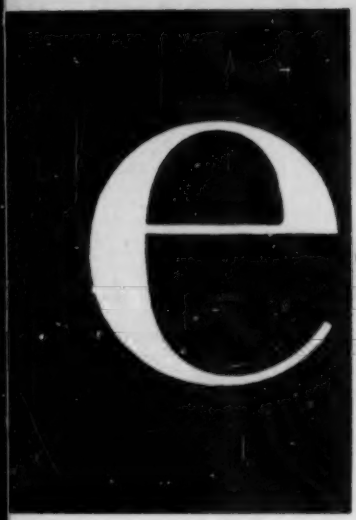

Eugenics Quarterly

1959

Vol. 6 March, 1959 No. 1

EUGENICS AND FUTURE SOCIETY
Harry L. Shapiro

THE RESPONSIBILITIES OF PARENTHOOD
Robert A. Harper

RESEARCH ON ALPINE ISOLATES IN SWITZERLAND
Jan K. Moor-Jankowski, M.D.
H. J. Huser, M.D.

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Haemophilie B

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Hemophilia B

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By

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H. J. Huser, S. Rosin, G. Truog,
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The third part of the Study is devoted mostly to the clinical manifestations of the disease and to the detailed coagulation studies of Tenna Hemophiliacs. The possibility of linkage of Hemophilia B in Tenna kindred with color blindness and with the ability to smell hydrocyanic acid is further evaluated. Finally, on the basis of the data on the Hemophiliacs from Tenna, an attempt is made to provide a general outlook on the genetical problems involved in the recent findings in coagulation physiology.

A mimeographed bilingual Register of Names, containing particulars of all 3,074 persons covered by the study, has been deposited in several European and American Genetic Institutes and may be consulted under observance of medical discretion.

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Eugenics Quarterly

Published by the AMERICAN EUGENICS SOCIETY, Inc.
230 Park Avenue, New York 17, N. Y.

Vol. 6, No. 1 March, 1959

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EUGENICS QUARTERLY is published March, June, September, and December. Office of publication, 3110 Elm Ave., Baltimore 11, Md. Editorial and business office: American Eugenics Society, Inc., Room 1523, 230 Park Ave., New York 17, N. Y. EUGENICS QUARTERLY is mailed to all members of the Society and to non-member subscribers. Subscription price $5.00 per year. Inquiries about membership in the American Eugenics Society should be addressed to the Secretary of the Society, 230 Park Avenue, New York 17, N. Y. Single current copies, $1.50; single back copies, $1.50.

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Vol. 6, No. 1, March, 1959 *Eugenics Quarterly*

EUGENICS AND FUTURE SOCIETY

HARRY L. SHAPIRO
President
American Eugenics Society

Presidential Address—Joint Dinner Meeting of the American Society for Human Genetics and the American Eugenics Society, August 22, 1958, Montreal.

I SUSPECT IT IS NO ACCIDENT in the intellectual history of Europe that eugenics was formulated in the nineteenth century. This was the century of the industrial revolution, of rapidly expanding urban centers, and of a public concern with the resulting human suffering. Its very beginning saw Malthus first focus serious attention on the quantitative aspects of population and the darkly looming problems associated with its unregulated growth. And it was midway in its course when Darwin published *The Origin of Species* and thereby provided a theoretical basis for the evolution of man and human population. Only a little later, while Mendel was analyzing the hereditary behavior of sweet peas in his monastic garden, Galton at about the same time in England was casting up statistical tables on the appearance of hereditary genius in England and arriving at conclusions bearing on genetic quality in human population. It was the century when Europe was filled with confidence in the perfectibility of man and society.

In the context of this unprecedented and growing concern with the problems and the future of human population, the questions of quality and its maintenance were bound to occur to thoughtful men. Out of this emerged eugenics. As an organized movement or program, however, it is typical of the traditions of Western democracy, and its history can be understood best in that frame. Based on the conviction that something could and should be done to improve the quality of human population, it is important to remember that eugenics in the United States was established as an association of private citizens to further their views and philosophy. They sought to do this by drawing public notice to the need for deliberate thought and action to preserve and even to improve the quality of human population. It was never a science in the sense that it occupied academic seats in the universities or had staked out a special restricted field of research for itself, although from its initiation it had always been supported by scientific workers who shared the fundamental beliefs embodied in eugenics. Eugenics has always been a

joint enterprise of scientists and laymen interested in applying to population problems the best scientific knowledge of the time.

One might have expected that a belief in the possibility of improving the quality of human population and a faith that acceptably sound means could be found for doing so might have attracted from the very beginning greater enthusiasm, particularly among men and women dedicated to science and aware of its varied achievements. But, in fact, eugenics has never been a widely popular movement. It encountered opposition from the general public, unaware of the basic problems to which eugenics was addressed and fearful of an invasion of their private lives if eugenics were adopted as a public policy. It also met with doubt from academic circles, doubt that the need for a population policy and action were pressing or even necessary, and doubt that any of the suggested means were likely to be efficacious in any event. It is true that the zeal of early eugenists not adequately grounded in science, or of eugenists who were operating in areas where science had nothing positive to say, had in the past led to the advocacy of programs that subsequently were discredited and shown to be of little value. And this in some circles did eugenics little or no good. This points up the difference between science and a program. The discredited theories of science have not discredited science. Instead, they occupy an honorable place in its history as preliminary and tentative approaches to the truth. Science, moreover, takes pride in its ability to learn by its errors. Eugenics, unfortunately, has not always been a beneficiary of the same tolerance.

Eugenics, like such words as democracy in the international scene today, also had its name used indiscriminately and sometimes for purposes of a distinctly biased character. And this too, I am afraid, did little to advance its cause. But in the past generation it is possible to discern a considerable change both in the attitude towards eugenics, at least on the part of students of population—both demographic and genetic, and in the closer rapprochment of eugenics itself with scientific advances in the areas pertinent to its interests.

Although these signs are encouraging, eugenics still has a long way to go in establishing the public attitude through which it can be effective. It is this I particularly want to discuss in relation to the pressure of world conditions we are facing today and are likely to face in increasing degree in the not too distant future.

The conviction that something can be done to regulate, control, and/or improve human population is a profound and ancient one. To achieve these ends only two ways have ever been suggested: one is by training, which means in the last analysis a manipulation of the cultural or social environment; the other is by genetic selection. Mankind has long been deeply and more or less consciously committed to the first. Every society, in fact, is based on the premise that the values and standards it has created can be maintained only by conditioning or training the young, and ultimately by providing the necessary environment to produce the kind of individuals regarded as desirable. And society, generation after generation, has quite readily accepted the burdens and the responsibility of providing the environment and the corollary training to carry it on. And indeed it is difficult, if not impossible, to see how any society could long endure, preserve the conti-

nuity of its traditions or adjust to new conditions without some process of training or education through the manifold ways open to an organized community.

But man has never been content merely to stabilize his environment. He has also throughout his history profoundly modified and developed the technological and other cultural aspects of it. His confidence in shaping his environment and educating himself to manage it successfully has never seemed to flag seriously or for any great length of time.

That society has been so successful in these efforts rest on the well-known adaptibility of man and his accessibility to education. The very range of social and cultural patterns demonstrates in itself the ability of the human species to respond to training and to the environment. And I need scarcely dwell on the highly significant value of this human trait in the evolution of mankind. For while human evolution, like all other episodes of organic evolution, can be explained biologically as the consequence of an interaction between the environment and genetic variation, it also differs from all these others in having pursued its course under a new kind of environment—a man-made environment that we call culture. Although some other animals than man exhibit behavior traits suggestive of culture, none of them aside from man has developed this phenomenon in all its characteristic phases, especially those of language and tool-making.

Cultural or social environment does not, of course, completely replace the natural environment. It is supplementary to it, but as culture becomes more developed and complex probably exerts an increasing degree of selection on the genetic variation presented to it. And, indeed, many more human characteristics than we commonly realize are adaptations to cultural rather than natural environmental conditions. Hence human evolution can in a sense be viewed as the progress of the human species in acquiring the ability to learn ever more and more complex types of cultural behavior. And culture, the specifically human environment, can in turn progress only as men become more adept at learning. Thus both culture and mankind have evolved more or less in an inter-dependent fashion. One can to a certain degree compare the process with a kind of feed-back system.

While it may be granted that any existing population has a greater potential of ability than society through inefficiency may actually utilize, and may therefore be capable at any particular point of time of sustaining a more complex culture than it does in fact, nevertheless it is difficult to see how culture can continue to evolve very far without corresponding genetic adaptations in the population that carries it. I know that students of human evolution are reluctant to place limits on the innate abilities of earlier types of men, and perhaps rightly. But the unavoidable inference of human evolution is that mankind has continuously increased its genetic abilities for cultural behavior as culture itself has evolved. And this can only have occurred through the selective pressure of culture becoming more and more complex and demanding. For obviously selection, one of the mechanisms of evolution, must also be operative in the cultural as it is in a natural environment. Thus man by shaping his environment has effected his own evolution.

I do not, of course, mean to imply that this process has been a carefully thought-out one or that either man or his society have been consciously aware of

what they were doing. But in effect it has been man's development of his cultural environment that has kept the ball rolling.

Selection, however, as an instrument for enhancing or supporting social or cultural requirements has rarely, if ever, been adopted by society. In the few cases that are known of such practices, it is usually a kind of negative selection. Typical of most of them is pre-European Tahiti, where infants born with obvious physical malformations or other anomalies were allowed to die. Isolated instances are also known of a more positive kind of selection within limited groups to reproduce traits considered to be desirable.

I have no hypothesis to explain why society has so rarely adopted selective practices. This reluctance, if it can be given so active a connotation, can scarcely be laid to ignorance of their value. It must have been a matter of common knowledge and of frequent use during the thousands of years men have been selecting and improving plants and animals. And, in fact, individuals from time to time have not hesitated to point out the obvious applications of these principles of selection to human breeding.

In the past, however, the cultural environment of man changed slowly. In the Paleolithic we know that technologically little or no change can be observed in human artifacts for periods of thousands of years. In a general way, however, the tempo of cultural change since then has been increasing at a steady rate. As knowledge accumulated, the process of change and development became more rapid. Within our own recent history we have seen how vertiginous this can be, and how profoundly our lives can be affected by such radical alterations.

It becomes a serious question whether the selective process, which obviously could and did function in a slowly changing environment, can maintain the balance that has so effectively advanced human evolution in an age of rapidly changing culture. I would hesitate to advance any serious estimates on the time required for selection to function effectively in either a primitive society or in an atomic age, but we must consider the possibility that as the cultural environment of man develops with increasing rapidity that the selective process will be unable to keep pace with it. We have only to think of our society one hundred years ago, with its relatively simple scientific technical requirements compared with the vastly higher requirements of skill and training necessary to maintain and advance our present society, to become aware that the margin of safety between the pressures of culture and population potential may become dangerously narrow in the foreseeable future. This danger seems all the more imminent if our cultural environment continues steadily and with increased rapidity to reach still higher levels of scientific and technological demand. The pressure to find more and more people capable of the education and training that modern society requires has already become a matter of public attention and concern, not only in the United States where such needs are probably maximal but in other countries as well where serious efforts are being made to adopt the standards and achievements of Western culture. I do not mean to suggest for a minute that we have necessarily run out of sufficient talent. But I do mean that the time has obviously come when the careful husbandry of whatever

talent and quality a population possesses is not only essential but that the adequacy of its supply will have to be taken into account. It is perhaps no longer possible to relax in an easy reliance that our human resources will be sufficient indefinitely to the demands that may be laid upon them, or to assume that the effectiveness of selective processes left to themselves will take care of the situation with a rapidity that will meet future requirements.

The urgency of the problem of quality when seen in this light becomes increasingly significant for modern societies engaged in deadly competition with each other. Competition between communities, tribes or nations is no new thing in human history. Success of one over the other in the past, of course, turned on a variety of factors, mostly—according to current interpretations—of such a nongenetic nature as superior organization, more adequate resources, more advanced military techniques, superior training or discipline, and other similar cultural or environmental conditions. If differences in the innate qualities of contending populations played a decisive role, we have little or no evidence for it. At least, that would not be a widely held view. That cultural environmental factors may continue to decide such issues in the near future, I am certainly not prepared to deny. But it seems to me a distinct possibility that as the technological and scientific requirements of our rapidly evolving civilization continue to raise ever higher standards, the necessity for taking thought about the genetic potential of our population may become a very real issue in survival.

Now I need not stress that in the tradition of democracy the problem of guarding and even improving the genetic quality of our population must be solved by a program that has popular acceptance. Any solutions that smell of force or duress cannot be admitted. There is, therefore, a serious and heavy responsibility for those who believe in eugenics. They must bend every effort to encourage investigations of an impartial and scientific nature to determine what factors are affecting the quality of our population and whether or not the balance between it and culture is sound. And based on such researches they must develop a program of information and action that will be acceptable to a free, democratic society. The task is difficult, but it is worthy of our best.

THE RESPONSIBILITIES OF PARENTHOOD

A Marriage Counselor's View

ROBERT A. HARPER*
Washington, D. C.

WE NEED NOT LOOK HARD OR LONG to find significant problems about which many contemporaries are apathetic, insular, irrational, and ignorant. As readers of this journal well know, a more than equitable portion of the unscaled fortresses of public misinformation and superstition center about such topics as genetics, eugenics, and population (3, 4, 12).

In the professional specialty of premarital, marital, and familial counseling, which is related to the foregoing topics most directly and obviously through heredity counseling, there is little current activity designed to guide clients on matters directed toward population limitation and improvement. So far as can be judged from professional meetings and correspondence, as well as from the official literature, hereditary matters are not a major concern of most marriage counselors. Not many counselors routinely inquire into such matters as the following with their premarital and marital clients: the practical risks of parenthood under conditions of consanguinity (10), mixed Rh blood factors (13), or family histories of schizophrenia (1, 9), allergies, diabetes, mental retardation, nervous system malformations, harelip and cleft palate, clubfoot, etc. (11). Although it may be argued with considerable validity that it is asking too much of a marriage counselor to expect him to be well informed on these subjects in addition to an already broad and heavy load of presumed expertness, it is to be hoped that more counselors will learn about and use heredity counseling services which are increasingly available (5, 6, 11).

Even if we take a kind and lenient attitude toward the sociologically and psychologically trained marriage counselor who lacks genetic and eugenic sagacity, we must call him to more severe accounting on environmental means of population improvement. The writer is particularly concerned about many of his colleagues who take a generally benevolent, encouraging, and even strongly urging approach to the bountiful reproductive activities of couples who are patently unqualified socially and psychologically for *excelling* in parenthood. Accumulating quantitative population problems are surely by now a sociological truism, and the need for qualitative population improvement is reflected in every area of scientific life. Many marriage counselors nevertheless insufficiently question the traditional assumption that parenthood is desirable

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not only for "nice, average couples" but even for the moderately dull, deficient, and disturbed.

Euthenics, then, not alone eugenics, strongly suggests a most cautious and highly selective policy for marriage counselors regarding the clients they lead toward parenthood. How have many counselors remained immune to such suggestion? The unhappy answer seems to be that most sociologists, psychologists, and psychiatrists are perhaps still too deeply immersed in the myths of their own culture about the social desirabilities, individual benefits, and moral blessings of parenthood that they are not as adept at applying rational thought and scientific understanding to the matter as we should like.

The writer has analyzed some of the social and psychological difficulties of the marriage counseling profession in two other papers (7, 8). We shall here center our attention on various propositions about parenthood which diverge from the points of view, stated or implied, of many marriage counselors. These are tentatively held beliefs (subject to correction by much-needed research), but they are made in the form of rather unqualified assertions for the sake of clarity, readability, and (hopefully) challenge to prevailing prejudices about parenthood. Although the statements are specifically directed toward parenthood in contemporary American society, they are probably more generally true.

1. The *only* time reproduction is truly desirable for the children, for the married couple, and for the general society is when (a) the husband and wife are considerably above average as phenotypes and (insofar as it can be determined) genotypes in such traits as mental and physical health, intelligence, emotional and social maturity, and creative and adaptive skills; (b) the marriage is a very happy one; and (c) *both* the husband and wife not only want children in a sentimental sense but are *eager to make parenthood their main enterprise* for the next quarter of a century and realize that this task means a lot of hard study, hard work, and the sacrifice of many other satisfactions.

2. Very few people meet all three of the foregoing criteria. There are a fair number of healthy, intelligent, mature, creative, adaptive people who are quite successful in business or professional activities who think that marriage and parenthood can be successfully pursued as an avocation to which they give little time and attention and for which they have little or no preparation. The facts are that in order to be even moderately successful in marriage and parenthood, under contemporary social circumstances, a great deal of time and energy and skill are required. Often indifference at worst or unskilled good will at best is all basically competent people offer family life: they have already given most of their available time, energy, and talent to out-of-home careers.

3. The relatively few couples who do fulfill all of the standards mentioned in our first point are likely to have their happy marriages made happier by children. In fact, for this minority, the joyful labors of parenthood probably bring as deep a sense of creative achievement as is available in life.

4. Under present-day social conditions, ancient conceptions about *duties* or *rights* of having children are quite inappropriate. "Be fruitful and multiply" is exceedingly poor advice in the

face of world over-population and accompanying social problems. Concerning the matter of *duty,* married couples who choose not to have children are being much more dutiful citizens in the light of contemporary social realities than those who do have children. The former are at least not adding to the overall weight of population or of the social and psychological problems which tend to arise from duty-inspired offspring. As for any *rights* that genetically, sociologically, and psychologically unqualified people may have to enter parenthood, these are privileges which have been socially granted and which may be socially removed. All individual rights are subject to the limitations set by the welfare of the society to which the individual belongs. Although the truth is recognized by only a pitifully few of those who influence public opinion in most countries, there is a real and imminent danger to the whole world society by the continued indiscriminate exercise of individual rights to parenthood.

5. Just from their own narrower points of view, happy couples who do not prepare themselves seriously and well for the hard work and real sacrifices of parenthood are often in grave danger of having their previously sound marriages undermined by the arrival of children and the accompanying increase in life's stresses.

6. Even more definitely, couples who were relatively unhappy prior to children are likely to find that the additional burdens of parenthood bankrupt their marriage and bring real and lasting misery. Unhappy marriages are not rendered happy by having children.

7. Many of the people who urge married couples to have children and try to make them feel guilty if they do not are resentful of the freedom and enjoyment of life shown by some childless couples. "I'm tied down with a life I dislike with children (doing my duty); why shouldn't you be likewise?" is what probably goes on covertly in some of the people who are overtly saying: "Nothing like kids to make life worthwhile." Such propagandists for reproduction are malefactors, not benefactors, of the couples, the children thus reproduced, and mankind in general.

Such observations as the seven just made are apt to be judged as evil by some persons, but any less severe approach to the responsibilities of parenthood seems to me to be stupidly antisocial. My perceptions of the current situation add up to the generalization that whenever parenthood is an involuntary function and/or one for which the individual is grossly unsuited, ill effects are very likely to ensue for all parties concerned. Both the matter of desire and competency for parenthood are, however, relative. No parent is wholeheartedly happy about his role as a parent, and certainly no parent is perfectly equipped for the responsibilities of parenthood. But surely people who are functioning as parents predominantly contrary to their wishes and skills do injustice to themselves, their children, and their society.

Let us take a closer look at some of the attitudes and competencies needed for parenthood. The first attitudinal prerequisite is a happy marriage. This does not mean that every happy couple is automatically qualified to be parents, but without such happiness none is fully qualified. Research studies undertaken from widely variant psychological, psychiatric, sociological, and psychoanalyti-

cal angles point with unanimity to the great significance of the home environment and of the parental influence in the development of the personality of the child.

One of the two parents, almost invariably the mother, has a greater quantitative and qualitative influence on the children. The home atmosphere and the maternal attitudes are to a very considerable degree a reflection of the marital relationship. That is, one of the main interests of the mother is her marriage, out of which these children have emerged. Her attitudes are predominantly optimistic and happy or pessimistic and depressed as a result of the happy or unhappy nature of her relationship with her husband. In addition to the direct bearing of the mother's attitudes of happiness or unhappiness on the children, there is the home atmosphere, the feeling tone of the family, which is chiefly set by the nature of the husband-wife interactions. The children are directly and indirectly affected by these interactions.

It is common practice to make married couples feel that they are abnormal, selfish, and in other ways unworthy for not having children. After a short period of marriage, childless couples are often subjected to jokes, questions, cajolings, accusations, etc. Such propaganda is not only in poor taste from any point of view (for the childlessness may be involuntary) but is most specifically inappropriate when the lack of children is a reflection of the lack of desire for them on the part of either person in the marriage. Certainly high motivation for parenthood is another essential attitudinal requirement for its successful fulfillement. Just as we would not urge a career as a jet pilot on a lad who shows disinclination to fly, no more should we propagandize the joys and virtues of parenthood for couples who show reluctance about having children.

Competency to deal with difficult situations under long-term stress is another characteristic needed by persons who would be better-than-average parents. Let us make no mistake in underestimating the additional stresses that parenthood places on a couple in contemporary society and in overestimating the number of persons who are capable of successfully handling these stresses in a way that will assure health and happiness for themselves and their children.

There is a condition which accompanies some brain injuries and diseases psychiatrically referred to as anosognosia, the denial of illness. A patient with anosognosia may be paralyzed in his right arm, for example, and yet stoutly deny the existence of the paralysis. He apparently so reorganizes his perception that he is able to "remove" the paralyzed limb from his field of perceived reality. He is afraid to face the reality of paralysis; he feels comfortable in denying reality.

The denial of the difficulties, the burdens, the displeasures of parenthood, I propose, involves much the same psychological process as the denial of illness in the brain-injured. Many of us are afraid to face the unhappy realities of parenthood; we feel more comfortable in denying these realities, in believing the myth that having children is a sure route to happiness.

Despite the travail brought to the life of the average couple by the arrival and continuing presence of children, it is nevertheless true that at least the mother (and sometimes even the father) finds sufficient compensation for efforts made

during the children's infancies. Babies for a short time are dependent, cuddly creatures. Even for a mother who is not very mature, loving, or dedicated to the disciplines of parenthood, there are many narcissistic satisfactions she can derive from this small, pliable, helpless extension of her ego. For the first year or so of the child's life, the mother (and to some extent the father) can enjoy the satisfactions of a life created (and the alleged virtues of so creating) and of a love unquestioningly accepted: a life and a love totally dominated and possessed.

Infants do stop being infants, however. They develop actions and ideas different from those of the parents. Even by the beginning of the second year, they undertake behavior that demonstrates a will of their own. The narcissistic satisfactions of absolute power, of total domination and possession, are more and more lost by the parent. The child needs to grow toward independent functioning as a separate human being; the parent needs to desire and assist this growth toward independence for the child. To fulfill this responsibility, to help a child to become gradually an adult, to provide the wise and happy and steady guidance this child needs to become a mature and loving and productive human being: this, beyond doubt, is one of the most important and most difficult of human tasks. It takes an exceptionally capable and loving and integrated and mature person adequately to fulfill this job. It is not a task that the average person can successfully muddle through.

Such, then, briefly are some of the responsibilities of parenthood and some of the rare attitudes and competencies required to meet them. It is surely most important and desirable for a considerable number of happy, well-adjusted, healthy, and intelligent world citizens to dedicate themselves to continuing reproduction of the human race, just as it is important and desirable for a sufficient number of persons with the requisite qualities to dedicate themselves to other activities closely related to human welfare such as science, medicine, engineering, law, education, and so. If we stop propagandizing the false virtues of indiscriminate reproduction and start educating people regarding the true values of qualitative population improvements, there is no reason to believe that many of the persons who are genetically, psychologically, and sociologically qualified will not willingly enter parenthood.

Meantime, education and counseling should bring out the realities of parenthood: its failures, its displeasures, its burdens. The qualified should not mistakenly believe that they have entered an easy, avocational avenue to joy. And persons who fail to measure up to what should be the increasingly severe requirements of child-bearing and -rearing had best be strongly discouraged about this route to self-fulfillment and encouraged to exercise their varying abilities in other areas of living.

Will such discouragement of massive and indiscriminate parenthood be dangerous for the future of the human race? Quite the contrary. Among the scientifically available reasons to fear for man's future (and there is no shortage of them), one will look in vain for insufficient reproduction. It is, indeed, only by preventing the domination of the human race by the genetically, socially, and psychologically unfit that

man's future can become the evolutionary fulfillment of his biological and cultural past. Man can no longer safely deny the reality that parenthood, as the most important and exacting of human responsibilities, should be open only to the trained, the qualified, the dedicated, and the skilled.

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RESEARCH ON ALPINE ISOLATES IN SWITZERLAND

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I. ADVANTAGEOUS POSSIBILITIES FOR RESEARCH IN SWITZERLAND

THE HISTORICAL DEVELOPMENT AND THE present demographic situation of Switzerland offer excellent possibilities for research in human genetics. Investigation both in medical and population genetics is greatly facilitated by the following facts:

Stability of Population

The Swiss population has to a great extent been established in the same sites for the last ten centuries or even more. During this period there were no major wars or social upheavals accompanied by migrations and exogamy. Internal migrations were rare before the late nineteenth century and can be easily traced, as will be shown here.

The predominant political and social function of the village and town communities in Switzerland since late medieval times has resulted in an accumulation of archival material pertaining to common citizens, such as is found in other countries only for members of high nobility.

Due to the relatively continuous peace the archives have been preserved until today and allow us to trace back throughout the centuries the origins of examined individuals or even of entire population groups. The possibilities for extensive genealogical investigation are enhanced by certain characteristics of Swiss citizenship, mostly unknown in other countries, hence of value for presentation here.

All male and female Swiss are hereditary citizens of a commune, which need not coincide with their place of birth or residence. The citizenship is handed down in the male ancestors' line; when marrying, the wife assumes the citizenship of her husband; illegitimate children, who are not recognized by the father, receive citizenship of the mother; foreigners acquire first the citizenship of a commune; on the ground of this citizenship they become Swiss nationals. Thus their foreign origins can be found in the commune's register.

The Swiss citizenship has at all times bestowed certain advantages attached to the respective commune, such as—among other things—the right to be supported in case of need and shares and usufruct in the property of the commune, *viz.* forests, commons, and Alpine pastures.

Tradition, national pride, and the privileges which this unique institution implies account for the care with which all pertinent documents and deeds have been preserved throughout the centuries.

Continuous records of births, marriages, and deaths of all the citizens of the commune were kept in churchbooks which in most communes date back to about 1600 and have been preserved until today. Earlier, less complete data can be found in the archives of the communes. In the second half of the nineteenth century a special law was promulgated which replaced the churchbooks with Citizens Registers, and these took over the ancient records. They are kept with a high degree of accuracy and thus constitute, together with the old churchbooks and the archival records, a reliable source for genealogical studies and for investigations of the past demographic situation of the communities.

Heterogeneity of Endogamous Population Groups

The population of Switzerland is highly heterogeneous. This heterogeneity is enhanced by the four national languages and innumerable dialects, by different origins of the population such as Celts, Romans, Gaels and Germans, and by different religions. The language, origins, and religious beliefs may vary from village to village in the same valley, the villages themselves being rather homogeneous units. Because of this historical development there is only a very limited interdependence between the language spoken in a village, the origins of its population, and its creed. Thus the descendants of German settlers from the tenth century could, in the course of centuries, have taken the Romansh language from their neighbors by cultural influence rather than by intermarriages prevented by feudal laws, and then become Protestants in the Reformation, whereas the neighboring Romansh villagers could have adopted the German language through the influence of a new feudal lord or of a neighboring town and remained Catholic. But the language, religion, and, to a certain extent, the different origins represented and still represent a marriage barrier, thus perpetuating the endogamy within and the heterogeneity between the relatively small groups of the Swiss population.

Finally, the geographic situation of the country has to be considered, with its innumerable large and small valleys, their population secluded by high mountain chains and, until recently, often completely isolated during the long winter months. This coexistence of numerous heterogeneous groups within the nation, which could have been concluded from a study of the history of the geographical configuration of the country, has been also proven by biometric investigations: we refer here to the basic work on Swiss anthropometry by Schlaginhaufen (1946) and to the study of the distribution of ABO blood groups in Swiss communes by Rosin (1956). Due to the few and clearly determined characteristics involved, this last study, unique because of its extent and methods applied, gives a particularly impressive picture of the heterogeneous mosaic of small population groups composing the whole country, with the exception of the average blood-group distribution in the few urban centers.

II. Problems of Research

All these uniquely advantageous conditions for research in human genetics have been already most beneficial for studies in medical genetics in Switzerland. We refer here to the extensive in-

vestigations of heredopathies in isolates by Hanhart and his school and to the wide scope of the research on hereditary diseases by Franceschetti, Klein, and coworkers in the Department of Human Genetics of the Geneva Medical School, where also a great part of our research on population genetics in Alpine isolates, to be described here, was carried out.

Studies in population genetics in Switzerland did not receive a real impetus until, in 1946, the first nationwide survey of blood-group distribution by Schuetz revealed an increased frequency of blood group O in Alpine communes inhabited by a population called Walsers. This observation, numerically too small to be significant, was later confirmed by investigations in some of the Walser communes (Knoll and Arendt-Knoll, 1949 - 1950; Moor - Jankowski, 1953), which also revealed villages with the highest known Rh-negative frequencies (Huser, 1953; Moor-Jankowski, 1954; Ikin *et al.*, 1957). At this stage, in 1952, we decided to make an extensive investigation of all Walser communes in Switzerland, which was carried out, after some pilot studies and preparatory work, with the financial support of the Swiss National Fund for Scientific Research in the years 1954-1957.

III. Description of Examined Alpine Isolates

What has been said about the heterogeneity of endogamous population groups in Switzerland is especially characteristic of the canton of Grisons. The greatest part of the 7,114 square kilometers of this southeastern canton of Switzerland consists of high mountain chains and high Alpine valleys; the population of about 130,000 can be roughly divided into the German-dialect-speaking population of the lower valleys in the North, Italian-speaking inhabitants of the lower valleys in the South, the three linguistically different Romansh populations in the higher Alpine territories, and the Walsers who dwell in the highest valleys and on mountain slopes often over the tree line and who, in turn, speak two different German dialects. For the purpose of our study we are mainly interested in the Walser and the Romansh populations.

Walsers

The people known as Walsers live in small communities in eastern and southern Switzerland, western Austria, and northern Italy; traces of their colonization can be found in Haute-Savoie, France. Their settlements resemble one another and are distinct from their neighbors culturally and linguistically. They migrated from Valais (southwestern Switzerland) in the thirteenth and fourteenth centuries, most probably from two great neighboring valleys as they can still be divided on linguistic grounds into two main groups, the eastern and the western; similar linguistic division has been found between the two valleys of their supposed origin (Hotzenkoecherle, 1944). They arrived as German-speaking free settlers, whereas the autochthonous population was Romansh-speaking and, for the most part, in feudal bondage. They were solely cattle breeders and owned their land on an individual basis, whereas the Romansh people raised their crops and shared their land in common, these differences existing until today. Moreover, the Walsers were intruders, and there are historical records of fighting and friction between them and the Romansh people, which further increased the marriage barrier maintained partly until today by mutual

POPULATION OF BOSCO-GURIN

Year	*Population No.*	
1253	16	male citizens of commune Bosco-Gurin, probably heads of families, mentioned in the first existing deed
1595		"Half the inhabitants died of plague"
1683	291	(first existing census)
1690	288	
1690	34	inhabitants killed by snow avalanche
1705	216	} Population decrease as result of the death in the avalanche of inhabitants of reproductive age
1716	187	
1729	185	
1741	219	
1749	41	inhabitants killed by snow avalanche
1753	182	
1761	168	
1761-1845		no data available
1845	395	
1850	412	Beginning of massive emigration because of overpopulation
1858	420	
1880	345	
1900	266	Decrease of massive emigration
1920	231	
1940	200	
1950	185	

tradition. No traces of cultural difference other than linguistic can be found today between the Eastern and the Western Walsers, neither are they recorded by tradition or history. However both groups colonized different regions, and, although there was an appreciable amount of intermarriage between both groups, the Eastern Walsers have in general mixed to a greater extent with neighboring people whereas the Western Walsers maintained a much stricter endogamy. Thus several of the Western Walser villages, but only a few of the Eastern Walser villages, can be considered today as isolates.

We have chosen the Western Walser village, Bosco-Gurin, to be presented here as a typical Walser isolate. It is the only German-speaking community in an Italian-speaking region. The census of 1950 revealed 185 inhabitants. This means a steady decrease in population over the last 100 years, as may be observed also in other Walser isolates.

The diminution of the population size during the last 100 years is due, in addition to the effects of emigration, to the decreased fertility observed in the most rural mountainous areas of Switzerland.

During the investigation in Bosco-Gurin there were about 150 inhabitants in the village; 128 of them were examined for ABO and 50 for the Rh factor. Almost all the ancestors of these persons on the male and on the female side were inhabitants and citizens of Bosco-Gurin. The village, like all Walser isolates, shows a high degree of inbreeding, which may be illustrated by the following example: The sibs Maria Antonietta T. (born 1933), Beatrix Candida T. (born 1935) and Hedwig Myriam T. (born 1937) were chosen at random. Their name (paternal side) is not to be found in the archival records before 1574. (Some names are to be found already in the middle of the fifteenth century, which facilitates genealogical research.) However, a complete ancestors' table of all ascending lines could have been established for ten generations. In the tenth generation the three sibs should have had 512 ancestors. For comparison purposes it may be mentioned that the most inbred known ancestors' table for

the European aristocracy, that of Alphonse XIII, King of Spain, shows 70 separate ancestors in the tenth generation (de Battaglia, 1948). The sibs T. from Bosco-Gurin, however, show in the tenth generation only 56, or even 52 ancestors (two ancestors could not be traced back from the ninth generation). Furthermore, the eleventh ancestral generation of the sibs T. is two-thirds complete and suggests an even greater degree of inbreeding.

No heredopathies were observed by us in Bosco-Gurin, nor are they retained by tradition or local history. In fact we have not met an increased frequency of hereditary diseases in any of the isolates examined, although family traditions, churchbooks, and commune archives allow a certain degree of insight even into the health conditions of past centuries: such was the case in our study of the hemophiliacs of Tenna, one of the Eastern Walser isolates, where the existing records transmit the diagnosis of hemophilia over 250 years, and enabled us to follow up over 3,000 descendants of an ancestral hemophilic parent-couple from the first half of the seventeenth century (Moor-Jankowski *et al.*, 1958).

Romansh Population

Our outline on the Romansh population follows the unpublished paper by the Romansh scholar Dr. A. Schorta, to appear soon in our monograph on Alpine isolates.

The Romansh people are considered to be the autochthonous population of Grisons, where the first traces of inhabitants date back to 2,000 B.C. but reveal no indication of their origins. The first inhabitants whose origins are hypothetically known were immigrants from northeast of Europa about 1,000 B.C. Later on, in the Middle Iron Age, the findings indicate a close contact with the Veneto-Illyric culture. Shortly before the beginning of the Christian era there must have been influence from nearby Celtic Helvetia and Cisalpine Gallia, still visible in Celtic names of localities and retained in certain words in the Romansh language.

At the time of the Roman conquest in the year 15 B.C., Grisons was inhabited by Raetier, a supposedly homogeneous population of long-time intermarried former autochthons and later intruders. During their rule of 550 years over this country the Romans in turn intermarried with the Raetier and developed the Raetoromansh language, the ancient form of today's Romansh dialects. The conquest of Grisons by the Franks in 536 did not interrupt this already well-advanced assimilation and did not bring the German language and colonization into Grison. This latter event in fact did not occur with full impact until the Walser immigration in the thirteenth and fourteenth centuries to continue until now. However, in spite of German cultural influence and immigration furthered by the feudal lords and by the predominantly German towns, in the more remote parts of Grisons Romansh isolates still exist inhabited by strongly endogamous descendants of the mixed Raeto-Roman population, who may be considered autochthons as compared to the Walser colonists. The degree of endogamy in these Romansh isolates revealed by genealogical studies impressed us as even higher than in the Walser isolates: entire villages of 200 to 300 inhabitants consist often of people bearing one and the same or two family names, related to each other as multiple cousins even in the present generation, and they often can be traced back to a common ancestor in the male line three

or four centuries ago. If we have not succeeded in obtaining in a Romansh isolate such a complete ancestors' table as in the case of Bosco-Gurin, this is due to the fact that our investigation was concerned mainly with the Walser isolates examined for the purpose of comparison. As it happened, the local records were less complete than in most Walser localities, probably due as much to chance as to the differing former social structure of these villages. However, the three localities, Savognin, Tinizong, and Salouf, are considered as typical Romansh isolates of very remote origins: this is documented by the village histories, the archaic language spoken, by their pre-Roman names, and by findings of traces of pre-Roman settlement on their sites.

IV. Seroanthropological Investigation of All Walser and Some Romansh Isolates in the Swiss Alps

Postulates of the Investigation

The determination of blood groups ABO and of the factor Rh (D) in about 1,000 inhabitants of four Western Walser isolates, carried out by us in the years 1952 and 1953, provided the needed statistical evidence of the highly significant deviation of these isolates in blood-group distribution from the Swiss average. An incentive was hereby given to extend our studies to other isolates

The preliminary investigations showed the importance of the following factors:

The villages to be examined had to be carefully chosen, as there is a social prestige attached to Walser origins, and the claim to be a Walser does not always correspond with the fact. A Walser commune can be defined not merely by the local tradition but, and much more exactly, by studies of the language, the form of the agriculture, and the archives containing deeds on local history.

Dependable determination of the degree of isolation of a village can be obtained only by genealogical research.

It was necessary to examine some Romansh isolates to obtain control material.

It seemed important to obtain, in addition to the blood-group data, anthropologic measurements and observations on the populations examined, and these data had to be secured by qualified anthropologists.

The blood-group determination itself is far more dependable if carried out in qualified laboratories and not in the field, as had been done in most of the previous studies.

All the above conditions were not fulfilled in the foregoing investigations, which thus had to be controlled or repeated.

Preliminary Studies

To carry out our program, we obtained the close cooperation of linguists, ethnologists, and historians in order to define the communes to be investigated.

The isolates among these communes and the extent of their isolation throughout the centuries were determined with the help of local historical data and by consulting the archival records, the churchbooks, and the Citizens Registers.

In such a way all the 21 Walser colonies in Switzerland populated until today by Walsers were included in our investigation, and the three Romansh isolates, Savoging, Tinizong, and Salouf, were added for examination for comparative purposes, in addition to some data obtained on the Romansh popula-

tion of the mixed Western Walser-Romansh village, Obersaxen.

During our investigation in 1952, cooperation was obtained from the author of authoritative studies on the physical anthropology of the Walser and Romansh people, Dr. K. Hägler, Director of the Natural Science Museum of Grisons. He continued his cooperation for the 1954 investigation, and we obtained additional assistance from Helena Kaufmann, Ph.D., assistant at the Anthropological Institute, Geneva University, and two other younger assistants. The blood samples were obtained by venepuncture by the authors of the present paper, aided by two medical students. The samples were sent by special dispatch to the Central Laboratory of the Swiss Red Cross in Berne (Director, Dr. A. Hässig), Laboratory of the Swiss Red Cross in Basle (Dr. L. P. Holländer), and to the Laboratory of Dr. J. Steinman in Geneva. The 1954 investigation was carried out mostly in the Eastern Walser and in three Romansh villages. The laboratory tests for the 1955 investigation in the Western Walser villages were performed by Dr. W. Ikin and Dr. A. E. Mourant, Blood Group Reference Laboratory, London, and by Dr. L. P. Holländer in the Swiss Red Cross Laboratory, Basle. (See Appendix for information recorded on examined persons.)

Scope of the Investigation

Blood groups were determined for about 4,500 persons altogether. This number also includes a group of individuals examined before 1954 where the results were proven to be correct by controls of large random samples. The population thus examined can be divided into approximately 1,600 Eastern Walsers, 2,300 Western Walsers, and 600 Romansh people.

The population examined represents about 80 per cent of the entire number chosen for examination in each village and varies from 50 to 100 per cent accordingly from village to village. The rest of the population chosen for examination but not actually examined consists of persons absent or gravely ill at the time of investigation; only about 5 per cent refused the examination. It must be added that the population chosen for the examination represented in most cases all the inhabitants of the village.

About 4,500 persons were examined: 1,100 individuals for ABO; 1,000 for ABO and Rh-standard (D); 2,400 for A_1A_2BO, Rh (C, c, D, E) and MN, among which 300 additionally for K and Fy^a; 150 were tested for A_1A_2BO, Rh (C, C^w, c, D, D^u, E, e) MNS, Henshaw, P, Lu^a, K, Le^a, and Fy^a.

Seroanthropological Situation of the Walser and Romansh Isolates

The earlier stages of the investigation of the Walser isolates have shown physical measurements and observations (Hägler, 1941 and 1954; Wettstein, 1910) and the serological tests (Moor-Jankowski, 1954) to bear out, on the whole, the evidence of history, culture, and language. It is, for instance, interesting to see the linguistic differentiation in the Eastern and the Western Walsers confirmed by the serological tests, although the different origins of these closely linked neighboring groups were not recorded by history, are forgotten by tradition, and cannot be detected in the common culture. Serological tests show the Western Walsers to stand out much more distinctly from their neighbors than do the Eastern Walsers. The Western Walsers also differ markedly from their neighbors in their anthropometric

characters, characters as yet insufficiently studied in the eastern group.

As a whole the isolates examined display an extreme and often highly significant variability of blood-group frequencies (Huser, Moor-Jankowski, Rosin, 1956). The common characteristic to be found in almost all Walser isolates is the low frequency or absence of A_2.

The more endogamous Western Walsers show as a common serological characteristic high O frequency, in fact the highest ever found among the white population; this frequency was found in about 2,300 people examined in 15 villages. In most of the villages gene O was found in 75 to 81 per cent or more of the individuals tested. The same population also shows a gene B frequency of less than 4 per cent in the more isolated villages.

The less endogamous Eastern Walsers show a great variability of ABO distribution, some villages with 80 per cent of their inhabitants having gene O and other villages displaying rather low O and high A frequencies, one of them with 41 per cent of gene A. The frequency of B varies from one village to another.

Both the Eastern and the Western Walsers show highly significant differences in the Rh (D) factor distribution from one village to another, some villages with 30 per cent Rh-negative or more, which represents the highest-known frequencies, higher even than those of the Basques; on the other hand, in some other villages the Rh-negative frequency is lower than the Swiss average.

The computation of our results for other blood-group systems is not completed as yet, but so far they seem to be near to the general European figures. The Romansh isolates correspond in general for all blood-group systems with the Swiss average*.

*For more complete results and comments the reader is referred to the authors' monograph on Alpine Isolates to be published this year.

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APPENDIX

Information Recorded on Each Examined Person

The following data were recorded on each person examined, anthropometry being performed solely on persons 21 to 39 years old:

Provisional number
Final Number
Location of investigation
Date of investigation
Place of residence
Surname (and maiden name)
First name
Commune of origin of paternal ancestor
Commune of origin of mother's paternal ancestor
Profession
Birth date
Age
Photographed (yes or no)
Observer
Transcriber
Spouse no. (if examined)
Father's no. (if examined)
Mother's no. (if examined)
Sibs' no. (if examined)
Children's nos. (if examined)

Body height
Sitting height incl. bench height
Sitting height

Length of legs

Maximum head length
Maximum head breadth
Maximum bizygomatic diameter
Mento-nasion height
Nose height
Nose breadth
Trunk/stature index
Skelic index
Facial index
Nasal index
Kin: relation and no.

Head hair color by Fischer-Saller Scale
Character of head hair (straight, wavy, or curly)
Eye color
Nasal profile (straight, convex, or concave)
Junction of eyebrows (marked, medium, or none)
Profile of occiput (straight, protruding, or markedly protruding)
Finger length (comparison of the II and IV finger)
Handedness (left, both, or right)
Ear lobe (free, half-free, or fused)
Darwin's tubercle (tubercle, pointed tubercle, or none)
Curling of the tongue (total, half, or none)
Baldness (total, half, or none)
Color blindness (total, partial, or none)
PTC tasting ability (bitter, slightly bitter, or no taste)
Genealogic division in: "Pure" Walser "Pure" Romansh
"Half" Walser "Half" Romansh

Blood groups
Remarks

REGULATION OF OFFSPRING AND THE ROMAN CATHOLIC CHURCH

NAN AHEARN

DURING THE REIGN OF POPE PIUS XII, 1939-1958, world population underwent many changes, and population rapidly increased in the years following World War II. The economic and social effects societies have suffered because of this increase did not pass unnoticed before His Holiness. As the family is the basic unit in society, it was the family that was affected; and from the beginning of his reign Pope Pius seemed to have as one of his most solemn objectives the fostering of the virtues of a good family life. (1) At the outset of his reign he spoke of the "charge laid by God on parents to provide for the material and spiritual good of their offspring. . . ." (2) In his Christmas message of 1942, the Pope urged the members of humanity to look to their mission of the perpetuation of new life and the educating of children with true religious convictions so that humanity may fortify and reconstitute "its proper economic, spiritual, moral and juridic unity." (3)

Today the Catholic Church is often accused of ignoring these social obligations by uncontrolled encouragement to young couples to have many, many children despite economic or medical reasons which may indicate that a large family would be unwise. This alleged line of thinking is not in concurrence with the Church as evidenced by the late Holy Father's many allusions to the social obligations of parents:

> "Do not let the family be alienated or diverted from the high purpose assigned to it by God. God wills that husband and wife, in loyal fulfillment of their duties to one another and to the family, should in the home transmit to the next generation the torch of corporal life and with it spiritual and moral life, Christian life; that within the family, under the care of their parents, there should grow up men of straight character, of upright behavior, to become valuable unspoiled members of the human race, manly in good or bad fortune, obedient to those who command them and to God." (4)

In his speech to the Italian Workman's Association on the problems of workers at that time, June 1948, he lists the necessities which must urgently be provided for the family: food, clothes and housing; the children's education; wholesome recreation for soul and body. (5) And again in 1949 when Pius XII addressed an international congress of Catholic doctors on the subject of artificial insemination, he stressed that by the inalienable, nontransferable rights of parents "nature imposes on whoever gives life to a small creature the task of its preservation and education." (6)

In 1951, in the address given to the Italian Catholic Union of Midwives,

Pope Pius XII made some of his most definitive statements on the practical carrying out of these obligations within the rules of the Roman Catholic Church. He speaks and, indeed, insists upon an intelligent approach to the conception of children and to the duty of parents to provide for their education, and he indicates the lofty position man has as a rational being in the procreation of the human race:

> "In matrimony, for the procreation of life, the Creator has destined human beings made of flesh and blood, endowed with minds and hearts: they are called as men, not animals without reason, to be the makers of their descendants." (7)

However, in referring to the practical applications indicated by parental duty, the Church does not condone the use of the sterile period, commonly known as the "rhythm method," for purely selfish reasons on the part of a couple who just do not want to be bothered with children. Pius XII states that the moral licitness of the use of "rhythm" by couples "would have to be approved or denied according as to whether or not the intention of observing those periods constantly was based on sufficient and secure moral grounds. The mere fact that the couple do not offend the nature of the act and are prepared to accept and bring up the child which in spite of their precautions came into the world would not be sufficient in itself to guarantee the rectitude of intention and the unobjectionable morality of the motives themselves.

> "The reason for this is that marriage obliges to a state of life which, while conferring certain rights also imposes the fulfillment of a positive work in regard to the married state itself. In such a case, one can apply the general principle that a positive fulfillment may be omitted when serious reasons, independent from the good will of those obliged by it, show that this action is not opportune, or prove that a similar demand cannot reasonably be made of human nature.
>
> "The marriage contract, which confers upon husband and wife the right to satisfy the inclinations of nature, sets them up in a certain state of life, the married state. But upon couples who perform the act peculiar to their state, nature and the Creator impose the function of helping the conservation of the human race. The characteristic activity which gives their state its value is the *bonum prolis*. The individual and society, the people and the state, the Church itself depend for their existence in the order established by God on fruitful marriage. Therefore, to embrace the married state, continuously to make use of the faculty proper to it and lawful in it alone, and on the other hand, to withdraw always and deliberately with no serious reason from its primary obligation, would be a sin against the very meaning of conjugal life.
>
> "There are serious motives, such as those often mentioned in the so-called medical, eugenic, economic, and social 'indications,' that can exempt for a long time, perhaps even the whole duration of the marriage, from the positive and obligatory carrying out of the act. From this it follows that observing the non-fertile periods alone can be lawful only under a moral aspect. Under the conditions mentioned it really is so. But if, according to a rational and just judgment, there are no similar grave reasons of a personal nature or deriving from external circumstances, then the determination to avoid habitually the fecundity of the union while at the same time to continue fully satisfying their sensuality, can be derived only from a false appreciation of life and from reasons having nothing to do with proper ethical laws." (8)

One month later, on November 26, 1951, His Holiness addressed a group in

Rome and strongly reaffirmed his earlier position of encouragement and commendation to those who are able to have large families and an understanding of those for whom many children are practically impossible. He expressed the hope that medical science would be able to perfect a more certain method of regulating offspring which is in accordance with the teaching of the Catholic Church:

> "Since, too the primary office of matrimony is to be at the service of life, the expression of Our principal gratification and of Our paternal gratitude goes to those generous mothers and fathers who, for the love of God and with trust in Him, courageously raise a large family.
>
> "On the other hand, the Church knows how to consider with sympathy and understanding the real difficulties of the married state in our day. Therefore, in Our last allocution on conjugal morality, We affirmed the legitimacy and, at the same time, the limits —in truth very wide—of a regulation of offspring, which, unlike so-called 'birth-control,' is compatible with the law of God. One may even hope (but in this matter the Church naturally leaves the judgment to medical science) that science will succeed in providing this licit method with a sufficiently secure basis, and the most recent information seems to confirm such a hope." (9)

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THE INNOVATING SPIRIT IN OUR DAY*

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AT FIRST GLANCE, it seems curious that in an age which offers unparalleled challenges to break new ground, in an age which probably presents the richest fabric of novel enterprise in all human history, truly great innovation should still be a comparatively rare event. Even more striking is the rare and precious quality of the innovator himself, relative to the comparatively huge and ever-growing number of fine minds devoted to the scientific way. It is hard to escape the impression that the opportunities for original advance have not been as fully grasped as they well might be.

This rarity of innovation, and innovators, of course, is as old as man's experience. We are so accustomed to the notion of continuous progress in our modern world that we find it hard to comprehend that real progress has been the shining event, not the rule, of human history. . . .

One reason for the historical rarity of great conceptual innovation in more recent times undoubtedly lies in the difficulty of its communication—not so much in its failure to be recognized as in the misconstruction of its message. The followers of Darwin, after his death, introduced all sorts of implications extraneous to his theory. They applied it to areas where it was quite inappropriate, which he was especially careful to avoid, generating misconceptions that have required two generations of intensive work to clear away. The discoveries of Gregor Mendel, the monk of Altbrünn, whose epoch-making experiments in the heredity of garden peas and the conclusions he drew from them were models of precision in measurement and clarity of reasoning, set the whole stage for modern genetics. But they were of necessity published in a local journal, obscure and little read, and so were lost for almost thirty-five years. When they were finally unearthed in 1900, Mendel was already dead, and those who found his paper rediscovered only a part of his conception. They saw in his work, not his vision of a wide and grand design, but rather much narrower and more specific findings, to be tested by their own kinds of experiments. For this failure of communication, the whole science of genetics suffered for many years.

The intrinsic difficulty of great innovation and the numerous impediments to its communication are surely but two of the reasons for its comparative infrequency. An important and perhaps an ultimately limiting factor, of course, is the inherent rarity of the deeply inno-

*Excerpts from Reports of the President, Carnegie Institution of Washington, 1957-1958. Reprinted by permission of author and publisher.

vating mind. Perhaps we must accept as given the fact that in any human population there will be a low proportion of truly original figures. But we are far from certain just how low that proportion needs to be under the best conditions. The nature of those conditions demands the most serious consideration.

It is a striking paradox that, though our contemporary culture affords opportunities for creativeness probably unequaled in human history, it also poses hazards that may likewise be unequaled. One important kind of hazard is inherent in the very structure of thought and philosophy which may crystallize about a field of inquiry. Such well formed systems, when rigidly and tenaciously held, may constitute more powerful and dangerous barriers to the advance of concept and experiment alike than we ordinarily recognize. The more elaborate the pattern, the more adequate, the more satisfactory, the more self-consistent it seems, the more difficult it is to transcend and the greater may be the resistance to truly original departures from it. This paradoxical balance between the older thinking and the new is the more delicate because it seems inevitable that, although all new scientific concepts must transcend the older matrix from which they arise, if they are to become established and permanent they must also find firm links with it. . . .

There can be no more vivid examples of the tremendous power of a central idea in advancing or retarding innovation than those offered by the sciences of life and of mind, in our generation in ferment such as they have not known since the days of Galen or of Leeuwenhoek. The distinction between the "living" and the "not-alive" as two quite different and opposite categories is far older than even medieval science. From the days of Harvey it was refined even further, until, for almost-modern biology, it was not considered difficult in practice to characterize a newly discovered object as living or nonliving. Into our own time the life sciences almost unconsciously retained as a central concept a notion that actually had its greatest currency in sixteenth-century thinking. Implicitly, if not explicitly, the organism was commonly endowed with the "property" of life as a unique, inhabiting quality much as the alchemist endowed the burning body with phlogiston, or the early physicist the bar with weight and color, length and hardness, or the physician the bitter pill with taste.

Perhaps what did as much as anything to shake the central idea of life as a unique "inhabiting" property was the preparation of the "crystallizable" plant viruses a quarter of a century ago and the discovery of their long durability upon the shelf, so like a "lifeless" chemical, combined with the power to resume the lifelike properties of growth and reproduction after long periods when reinoculated to a suitable host. With that step taken, with the recognition that the "living" and the "nonliving" may in some contexts at least differ in degree rather than in kind, the advances of concept and experiment that now are in full tide crowded upon one another. Recent studies of the dynamics of metabolism, especially in microorganisms, have helped to replace the older notions of the structures of life as gross and essentially static morphologies, like cell walls and semipermeable membranes, with those far more exciting concepts of precise structural lattices and highly specific sites of adsorption which in the last years have become dominant. Radical experi-

ments in the synthesis of amino acids under conditions approximating those believed to have obtained on the lifeless earth, and illuminating researches in paleobiochemistry, have made common currency of the notion that living things may have indeed originated terrestrially, and have further obscured the division between the living and the nonliving. Quantitative biochemical genetics, the fine analysis of the structure and function of the chromosome that is proceeding apace today, with its accompanying new insights into the mechanisms of replication and its demonstrations of transduction and transformation, further reinforce the new ideas of biological systems as wonderfully complex dynamic structures of exquisitely detailed precision in both space and time. Some modern investigators of the structure of the chromosome see in it a precisely designed mechanism for the transfer of information, as truly an instrument of communication as any designed by man, and far more intricate in function. Indeed, it seems quite possible that in our time some of the new central ideas about living matter, whether as individual organism, as structured population, or as the changing product of evolution, will describe it primarily in terms of self-regulating, goal-directed systems to which modern concepts of information theory and information flow can profitably be applied. It is hard to realize the swift and tremendous strides of thirty years which the escape from too exclusive a preoccupation with an old idea has brought.

A similar revolution is beginning in the science of the mind, again consequent upon the abandoning of an older concept, this time even more confining. Here, to the notion of life as a "property" of living matter was added a further barrier—the central idea of the mind as fundamentally different in kind even from the living body, the *res cogitans* as distinct from the *res extensa*—inherited from the brilliant eighteenth-century advocacy of Descartes. It is only in the last few years that mind, too, has widely come to be regarded as a self-regulated, goal-directed dynamic system, structured, like life itself, with exquisite precision and almost unimaginable complexity in both space and time, but not necessarily differing in essence, not necessarily wholly beyond the modes of investigation already available to us. It is only now that the central idea of communication which has become so prominent in the life sciences—and indeed may be so important to the whole structure of science itself—has been extended to the subject of mind as well; that mental processes in some of their aspects are beginning to be translated, like the processes of heredity, into terms of communication theory and information flow. We can only speculate today what the consequences may be. As with the life sciences, experimental evidence is accumulating along the novel paths of thought that escape from the older pivotal notions has made possible, evidence provided from such diverse sources as studies of therapeutic neurochemicals and of electronic computing systems.

No more vivid historical examples, perhaps, could be cited of the long delays to basically new departures that too static and finished, too self-contained and self-consistent systems of thought may impose than these sciences of life and mind.

There are other barriers of a more practical sort. One of the profound ways in which the modern world nay

differ from other centuries is in its conscious recognition of, and its high respect for, the *fact*—but not always the *process*—of innovation. Recognizing its power, our own society would like to hurry it along, to enlarge its scale, to organize it more efficiently. Impressed as we are by the extent to which the processes of development built upon innovation can be accelerated by organization, we are greatly tempted to extend this thinking to creative matters, to believe that we can organize for great innovation too. Such misconceptions are peculiarly liable to occur in massive and highly organized environments devoted to research and development. They are inherent in the all-too-prevalent confusion between the processes of scientific research itself and of development, in the frequently uncritical transfer of ideas and techniques from development and production into the field of scientific innovation. Among them, too often, is the destructive concept that the effectiveness of innovation, like that of production, can be doubled simply by doubling the *size* of the accompanying effort. Some departments of research and development in industry and in government are particularly vulnerable, and the academic world is by no means immune.

But we should be well warned. It is deeply significant that, in our own time of unparalleled technical advance, in a day when engineering achievements built about new principles can accomplish unbelievable things, the great innovations are still highly individual, are still associated, at their inception, with a mere handful of names.

The comparative rarity of the environments most favorable to truly original investigation, their unusual and special character, and the frequent practical impediments to their best development may impose sharper limitations on the creative potential of our nation than we are inclined to recognize. Climates of research must comprehend many and varied elements, some of which are rarely joined in more ordinary situations. Important among them are understanding and protection. Since innovation is and must always remain a uniquely individual experience, it poses unusual social dangers for the investigator from which he must be adequately shielded—the animosity which the new, with its threat to current things, must often provoke. Such perils may not be fatal to the advance once it is fairly made. For if the advance is truly novel and important, and if the society in which it occurs is self-confident, it is likely to be eventually accepted and incorporated, and may even become symbolic. The greater risk is that the prospect of such hardships may inhibit the individual capable of great innovation from undertaking it or from fully developing its results. Such considerations of the hazards opposing the unexampled richness of opportunity for scientific creativeness in our society bring home anew the gravity of our responsibility to analyze most carefully this climate in which true scientific originality best flourishes and to see that environments embodying it are adequately provided and conserved.

It is not hard to set down the major tasks that institutions assuming these great responsibilities must perform. The most important, of course, must be the discovery, the encouragement, the adequate training of the outstandingly original investigator, and the fostering of his work. Such institutions must be unusually sensitive to the rare, natively innovating mind, and unusually adept in

its discovery. They must have in high degree the ability to promote and develop the peculiar drive, the special verve and flare, the fine sense of style, which great innovation inherently requires. They must be able to train the innovator of exceptional promise in the company of other gifted investigators already mature and at the height of their powers.

Above all, the environments that such institutions create must be unconventional and malleable. Their responsibility is not only to provide for the very different requirements of different workers, based in divergences of temperament, of method, of timing. It is also to meet the very different requirements of the same investigator at various periods of his working life. There must be ready, yet penetrating, astringent tolerance—and indeed welcome and encouragement—for the long preliminary phase of apparently rambling and aimless effort that so often and so characteristically precedes the great individual discovery or the brilliant innovational career, while the ground is being canvassed and a wealth of divergent but relevant material is being mastered and consolidated. There must be provision for the long intervals of seclusion and introversion that may be essential during periods of highest creativity, when white-hot effort will not brook interruption. There must be ample understanding and ample capacity to shield the worker in this his most vulnerable time from the insistent demands that will surely come to prematurely formulate results and conclusions only half-attained. Conversely, there must also be adequate provision for compensating periods of extroversion, when the immediate barrier is surmounted and the conclusions are consolidated and the extensive communication that must accompany or follow creativity is encouraged and sustained.

Institutions for creative research must be able to set and apply subtle standards of excellence. They must be able to judge and reward high standards by criteria more searching and more true than those too often and too superficially accepted. They must provide teachers of research of the very highest quality, and in high ratio to those they train—indeed, those primarily in training as investigators should, ideally, be in the minority. And they have one final and supremely important responsibility — the task of communicating the results of research rapidly and effectively to workers in fields that may seem far remote, yet may actually be contiguous to those in which the discoveries have been made. Such institutions will benefit greatly by being relatively small, and will almost certainly benefit, too, if they are somewhat decentralized, both physically and in the subject matter with which they deal.

The discovery and training of new generations of investigators in science are, of course, basically functions of the universities. Theirs must be a grave portion of the responsibility. But they are inevitably hindered in this special task by many of the current pressures that bear especially heavily upon them: the pressures to large size, to an everlessening ratio of teachers to students, to a lowered quality in the teaching staff itself, valiantly as this is—and must always be—resisted. Moreover, the whole mission of the universities is of course far broader. The training of great innovators, and, even more specifically, of great innovators in the scientific way, must always remain one of their most

important challenges. But it is, of necessity, a somewhat narrow sector in the total context of their work. They need assistance.

Such circumstances place renewed emphasis in our day on the great and continuing importance of the research institute in our national life. Its task is not only that of scientific innovation and discovery. This indeed is important enough. But, far more important, to it must fall the essential function of symbolizing in the best and purest form the way of scientific innovation with all that it means for our nation and our culture —undismayed and undeterred by pressure or by hazard. To it belongs the great responsibility of discovering and fostering new minds of high promise, of selecting them with discernment, of affording them a rare training as investigators, and then of seeing to it that their careers can be fulfilled where their talents are most effective. Far beyond the task of research itself lie the challenge and the responsibility to cultivate new minds through all the possible and relevant means—symposia and exchange fellowships, the flow to university and industry and back again, all the particular media of publication.

More and more, in our time, it is recognized that the true wealth of a nation resides not so much in the volume and the variety of goods that it can produce, not even so much in its total resources of production, but rather in two human factors more subtle, more powerful, more determining: in the quality and excellence of its people as a whole, and in their capacity for innovation. In the guarding, the fostering, the building of this last element of national wealth lies the ultimate challenge to such a research organization as the Carnegie Institution of Washington. Never in the history of science in our nation has that challenge been more exciting, that responsibility more keenly privileged.

BREEDING STRUCTURE OF HUMAN POPULATIONS

An Analysis of Distance*

MARCO FRACCARO
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THE QUESTION OF GENE DISPERSION and the related concept of isolation by distance are relevant to a number of genetical problems. Application of the theories to human populations is at the initial stage, but authors like Böök, Cavalli Sforza, Freire-Maia, Morton, Spuhler, Sutter and others have already made important contributions to the subject.

I wish to present some preliminary data pertinent to the population of the Parish of Ovanåker, which is located in middle-east Sweden and had, in 1944, 8000 inhabitants, in an area of 520 square kilometers, much of it covered by forest. Ovanåker is mostly a rural community, but some industrial activity has developed in recent years. It has good communications and no geographical barriers.

In the period 1900-1944 population size steadily increased and migration rates indicate that family size rather than immigration contributed to the increase.

Partition of marriages according to the birthplace of partners provides a better estimate of population mobility than crude migration rates. In the period 1850-1899, 62 per cent of marriages contracted in Ovanåker were between people born in the parish, while only 42 per cent of marriages were such in the period 1900-1944. The rate of marriages with neither partner born *in loco* remains constant. (Table 1)

TABLE 1

DISTRIBUTION OF THE MARRIAGES INVESTIGATED ACCORDING TO THE PLACE OF BIRTH OF THE PARTNERS

Partners born in Ovanåker	Period 1850 - 1899		1900 - 1944	
	no.	%	no.	%
Both	782	62.0	900	42.9
One	376	29.8	1027	49.0
Neither	104	8.2	169	8.1
Total	1262	100.0	2096	100.0

No significant difference as to the sex of the local partner is observed in the first period, while in the second the husband is significantly more often the local partner. (Table 2)

TABLE 2

SEX DISTRIBUTION OF THE LOCAL PARTNERS

Period	The partner born in Ovanåker is the		Total	x^2
	husband	wife		
1850-1899	176	197	373	1.18
1900-1944	578	435	1013	20.18

The geographical distance between birthplaces of partners was obtained by taking road distance in kilometers from church to church in the various parishes. Distances within Ovanåker were arbitrarily considered as zero.

*A paper read before the X International Congress of Genetics, Montreal, August 20-27, 1958.

Fig. 1. Location of the birthplaces and number of mates who have been married to persons born in Ovanåker in the period 1900-1944. The shadowed area is the parish of Ovanåker.

Figure 1 shows the location of the birthplaces and the number of mates born outside Ovanåker who have been married to persons born in Ovanåker in the period 1900-1944.

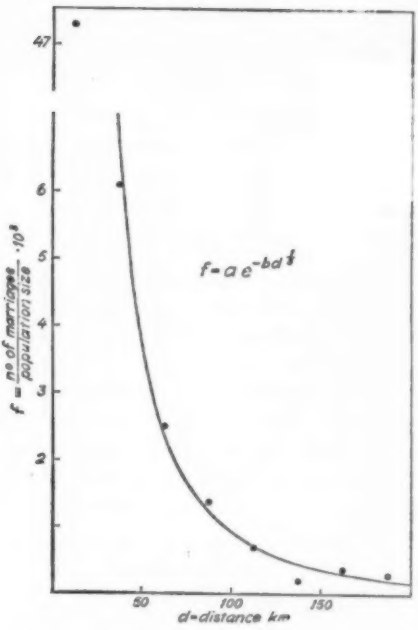

Fig. 2. Number of marriages as a function of distance (see text).

The distribution of these distances up to 200 km. has been analyzed. The earlier period did not provide large enough figures for an efficient analysis.

Figure 2 shows the number of marriages as a function of distance. The points are the observations and the line is the fitted regression line.

If the number of marriages is related to the population size at the various distances, the factor of population density is formally taken into account. This is shown in Figure 3, where f is now the ratio of number of marriages to the population size for each distance group around Ovanåker. The curve has approximately the same shape as before,

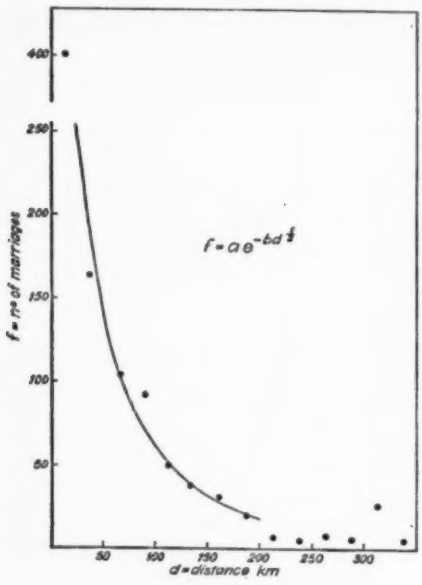

Fig. 3. Ratio n° of marriages/population size at each distance as a function of distance (see text).

but the best fit has been obtained by giving to d the exponent 1/5.

I am inclined not to assign much weight to these curve-fitting exercises. It is enough to note at this stage that the distributions are not normal but have a clear leptokurtic tendency. Several types of gene dispersion have been shown to be leptokurtic, as recently stressed by Bateman. Sutter has found, studying the distribution of distance in a French human population, the same type of distribution I have observed.

Sex and age of the partners should be taken into account and their effect on the distributions accounted for. This aspect of the analysis is still in progress, but I can anticipate that there is a significant heterogeneity within distances as to the sex of the local partner. A rough analysis of the relationship between age at marriage and distance has shown that the two parameters are probably not independent, but there is, at least for men, a positive correlation between age and distance.

The incidence of first-cousin marriages is 0.57 per cent of the marriages contracted in Ovanåker for the period 1900-1944. A special registration is not required for cousin marriage in Sweden; this estimate was obtained by collecting information concerning parents and grandparents of the index couple from the parish books. In doing this I obtained at the same time information on the birthplaces of the partners in three directly related generations.

The distance between these birthplaces has also been obtained. This material produces an opportunity to analyze directly the distance which separates the birthplaces of three generations. For the time being, I have analyzed only the distributions of the distance within the three generations.

Figure 4 shows the cumulative per cent distribution at various distances for the three generations. Some 74 per cent of marriages are between partners born in Ovanåker in the first generation, but 55 per cent in the third. The trend is the same at the different distances. Means and variances of distance between partners for the three generations are set out in Table 3. The variance increases from 4700 to 8600 kilometers from the first to the third generation. This would mean that the size of the neighborhood has increased, or, if you prefer, that the isolate has been broken down.

In conclusion, the analysis of the dis-

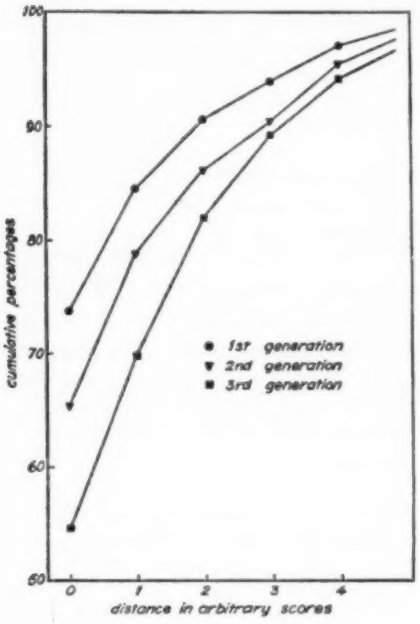

Fig. 4. Cumulative per cent distributions of distances between birthplaces of partners in three generations.

tributions of distance separating birthplaces of partners of marriages may provide us with an indirect estimate of the genetical homogeneity of the population under study. We should of course remember that different sampling techniques give us information on different aspects of the problem. As shown before, it should also be possible to account for some of the complicating factors like sex and age differentials. As shown by Malecot, analysis of distance gives estimates of the coefficient of relationship, and at the same time, of effective population size and mutation pressure.

When starting the collection of data as those I have presented, one frequently has the secret hope that they would fit some of the models provided by the theoretician. The process usually ends up in disillusion. The disillusion is however reduced by the thought that the observational data may at their turn help the search for improved and more realistic models.

TABLE 3

MEANS AND VARIANCES OF DISTANCE BETWEEN BIRTHPLACES OF PARTNERS OF MARRIAGE IN THREE DIRECTLY RELATED GENERATIONS (I is the older generation.)

Generation	No. of marriages	Distance (km) Mean	Variance
I	6102	21.7	4772.2
II	3151	29.4	7322.7
III	1659	41.5	8655.6

ACKNOWLEDGMENT

I am indebted to Prof. J. A. Böök for his valuable advice.

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PROSPECTS IN HUMAN GENETICS

EDITOR'S NOTE:

Where in human genetics can we hope to make the most progress in the next twenty years, both in regard to research and practical application?
This question was asked of a representative group of geneticists and doctors. The replies are published below.

GORDON ALLEN, M.D., *National Institute of Mental Health*

Selective agents acting on polymorphic traits (e.g., blood groups)
Mutation rates and effects of radiation on the population
Integration of human genetics with the medical disciplines
Useful empiric risk figures for genetic counseling
Detection of heterozygous carriers of hereditary disease
Estimation of human gene frequencies
Specification of human biochemical differences
Mapping of the human chromosomes
Pathways of gene action in disease
Elucidation of assortative mating patterns
Genetic race differences and consequences of mixture
Genetics of normal morphology
Identification of genetic variables in mental traits
(Listed in order of quantitative progress relative to present status)

C. LEE BUXTON, M.D., *Department of Obstetrics and Gynecology, Medical School, Yale University*

The effect of radiation on chromosomal mutations in anthropoids, but twenty years may not be enough time to more than begin a genetic study of this sort.

LEE R. DICE, *Laboratory of Vertebrate Biology, University of Michigan*

The great need in human genetics at the present time in my opinion is for more information about those factors that may be influencing differential fertility, especially for ability. Most of the studies that have been concerned with differential fertility have been inadequately planned. Fairly satisfactory measures of ability of various kinds have been devised by the psychologists. It is true that improved measures of ability are needed, but much use can be made of those measures now available. Improved statistical methods, especially those affecting sampling, also are needed, but again much progress can be made with the methods already at hand. Surveys of the distribution of ability and fertility in populations of various sizes and in all parts of the world are urgently needed. Such surveys will be expensive and will require high leadership and imagination to be successful, but we will never learn how to conduct such surveys until the attempts are made.

F. CLARKE FRASER, M.D., *Department of Genetics, McGill University*

Biochemical identification of mutant gene activity, including the detection of genetic carriers.

Evaluation of the extent and importance of heterozygote advantage and other phenomena that may influence gene frequencies.

Better understanding of the problems and development of better techniques in genetic counseling.

ALAN F. GUTTMACHER, M.D., *Department of Obstetrics and Gynecology, The Mount Sinai Hospital*

Congenital Malformations—There is a rapidly developing body of knowledge that a high proportion of human congenital defects are not wholly germplasm foreordained but are environmental in origin. To be sure, some genetic influence may be involved even in environmentally induced abnormalities; it may be shown that some chromosomal complexes are more susceptible to deleterious influences and other chromosomal complexes are especially resistant.

FRANZ J. KALLMANN, M.D., *Department of Medical Genetics, New York State Psychiatric Institute (Columbia University)*

My hope is that the most satisfactory progress in the next twenty years will take place in the following two areas:

1. Identification and therapeutic control of gene-specific metabolic deficiency states in those pathological conditions which are manifested relatively late in life so that the pre-clinical symptoms can be studied systematically. Such conditions are Huntington's chorea, Friedreich's ataxia, the pre-senile brain atrophies, hypertensive disease, and perhaps the cyclic and schizophrenic types of psychosis.

2. The development of counseling centers in medical genetics giving advice in the management of premarital and preparenthood family problems. In one way or another I believe that this development is inevitable, since its advantages are too obvious to be ignored much longer by interested professional groups.

TAKU KOMAI, *Emeritus Professor, Kyoto University, Japan*

Japan should be a center for genetic study. The Japanese belong to one of the major races of which very little genetic study has been made. They are genetically comparatively uniform, which makes some genetic studies with special objectives, such as determination of gene frequency and isolate effects, relatively easy. Japanese families are generally larger than in most European homes, while non-genetic perinatal and infantile deaths are probably less frequent than in some backward countries. Individual pedigrees are easy to follow because of relatively few emigrations and reliable official family records. The rate of consanguineous marriage is considerably higher than among Europeans, which is advantageous for studying recessive genes in the population. The Japanese are the only people who have been exposed to high-dosage radiation effects on a large scale; thus they afford unique material for studying the genetic and eugenic effect of such an agency upon mankind.

ROBERT W. LAIDLAW, M.D., *Roosevelt Hospital*

I would like to see further amplification of Dr. Kallmann's work, particular-

ly in the study of identical twins in the areas of mental illness. Such work should give us valid grounds to approach the question of heredity versus environmental factors in the psychogenicity of psychiatric disorders.

FREDERICK OSBORN, *The Population Council*

1. Discovery of the relationships between specific genes and individual biochemical and enzyme structures.

2. Discovery of means for identifying carriers of deleterious recessive genes, partly as a result of above.

Progress in practical application will be based on these discoveries and will not only put heredity counseling on a more exact basis, but even more important will enormously advance preventive medicine by early treatment among enzymatic and biochemical lines. These are the fields in which the younger men are working now, and they have appeal for the type of men going into human genetics today. The big jump to hereditary variations in the structure and functioning of the brain will require not only more knowledge but also more imagination, approaching perhaps on genius, as well as better tools.

I wish we could see some advance in our knowledge of the distribution and inheritance of familial traits of personality and intelligence, quite apart from their relation to specific genes. But this type of work, typified by twin and sibling studies, does not seem to have appeal for people in the field at present.

SHELDON REED, *Dight Institute for Human Genetics*

I think that the very broadest concept of counseling in human genetics includes educating the general public in an understanding of the goals of eugenics. Probably this work will be closely related to the counseling centers. Perhaps the greatest technical help that research can provide is in the field of the detection of the heterozygote, prior to marriage, for both dominant and recessive defects.

We are making an attempt to set up a Human Genetics Unit in the state of Minnesota Board of Health which would serve as an official counseling center and repository of data similar to the Genetic Hygiene Laboratory in Copenhagen. While we may be unsuccessful at this moment, I can predict that such centers will be established in some state governments during the next two decades.

J. P. SCOTT, *Roscoe P. Jackson Laboratory*

I believe that most progress in human genetics can be made in the following three areas:

1. The study of physiological traits which are basic to behavioral and temperamental differences.

2. The study of the development of these traits and also of behavioral differences.

3. The study of biochemical differences in metabolism, particularly those related to the metabolism of the nervous system.

These choices are concerned with application of heredity to behavior and do not consider the importance of studying physical traits, about which others are more competent to judge. My reasons for the above choices are as follows:

1. Gene action in behavior must take place through physiological reactions. These are much less affected by learning and experience than is overt behavior. In this way we may hope to arrive at a

description of the biological foundation for behavioral differences.

2. If the knowledge of the individual differences is to be successfully applied, it should be available as early as possible in human development so that a person could be provided with a favorable environment suited to his particular talents. More than this, the study of the development of behavior traits may give a clue to their nature. Studies on other animals show that behavior traits differ a great deal at different times in development.

3. Finally, the biochemical study of behavioral differences has many possibilities, both for therapy and for understanding basic nervous problems such as learning.

HARRY L. SHAPIRO, *Department of Anthropology, American Museum of Natural History*

In answering this question, so much depends on the unpredictable developments that are likely to give direction once they are found acceptable. For example, although twin studies at the present time have been somewhat disappointing, the fact is that if new methodologies or new insights are developed as a result of current work in this field the whole direction of interest might be very considerably affected.

I can more affirmatively say that, in my opinion, a promising field of study would be in connection with population studies as they are correlated with cultural factors. But this is an area which has hardly been touched by research.

LAURENCE H. SNYDER, *President, University of Hawaii*

The most progress in human genetics will probably be made in the field of biochemical genetics. A knowledge of the basic genic action underlying anomalies and diseases will facilitate diagnosis, treatment, and prevention. It will help to make it possible to identify heterozygotes and thus to elucidate precursory, preclinical and constitutional stigmata which can be employed in devising prevention and therapy.

It is becoming apparent that the primary activity of a gene is the control of the specificity of some substance, usually an enzyme. It is also clear that metabolism proceeds through a series of small sequential steps, each step catalyzed by an enzyme. Many enzyme dysfunctions have been shown to be referrable to specific mutant genes, and it is reasonable to presume that the production of normal enzymes is dependent on the activity of the normal unmutated alleles of these mutant genes. Enzyme dysfunctions, in turn, interfere with specific steps in metabolism and may lead to genetic disease.

An awareness of the foregoing facts makes it feasible to use mutant genes to identify the precise sequence of steps in various metabolic reactions, and to identify precursors, since in the absence of mutant metabolic blocks the intermediary products are generally converted in the cell as rapidly as they are formed and are thus difficult of detection. Thus the very mutant genes which result in disease are proving to be the keys of understanding, and thus, hopefully, of therapy and prevention.

Book Reviews

RECHERCHES SUR LES EFFETS DE LA CONSANGUINITÉ CHEZ L'HOMME (Studies on the effects of consanguinity in man): Jean Sutter. Biologie médicale, Paris, 1958. No. 85, pp. 563-660.

Detailed and conclusive studies on the effects of inbreeding in man are not very numerous because they require large bodies of data which are difficult to collect if they are to be as little biased as possible. Jean Sutter, who is *Chef de Service* at the *Institut national d'Etudes démographiques* of France, has just published the careful analysis of a most impressive collection of such data gathered in three rural French Departments: Morbihan and Finistère, which are both in the peninsula of Brittany, and Loir-et-Cher, located about one hundred miles south of Paris. In the three departments, a total of 1445 control families, grouping 4094 children, and 804 inbred families with 2256 children, have been investigated. The inbred offspring are divided into three categories of inbreeding based on the degree of relationship of their parents.

Sutter introduces his study with an interesting summary of the history of man's concern about the effects of consanguineous marriages in which he recalls the famous controversy, started in France in 1856, by a paper read at the Academy of Medicine. The author of this paper, Ménière, advanced that deaf-mutism resulted from consanguineous marriages. Soon, the learned societies of France were divided into two groups, one for and one against consanguinity, and during ten years, the debate went on, intense and at times violent, regularly reported by newspapers and reaching the Minister of Commerce and Public Works who published a circular on the subject.

The author then passes to the definition of the precautions necessary to make the study of the effects of inbreeding in man significant, of the various factors analyzed in his inquiry and of the methods used to localize, select, and investigate the control and inbred families.

The data collected are clearly presented in a large number of tables, subjected to statistical analysis whenever possible, and discussed with an evident knowledge of their value and limitations and concern for strict objectivity.

The following are among the many conclusions derived from this study. The percentage of sterile families is significantly higher among the inbreds but since this phenomenon is not positively correlated with the degree of inbreeding, a doubt exists as to its reality. Mortality, the proportions of families with dead, with abnormals, or with dead and abnormals are higher among inbreds. In families with many abnormals, the percentages of abnormals are also higher among inbreds than among controls. Finally, in consanguineous families, there is an evident degree of association between abnormalities of various kinds and between death and abnormalities.

This study by Sutter is indeed worth reading by all those who are interested in the effects of inbreeding, eugenics, human genetics and sociology.

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LA DYSTROPHIE MYOTONIQUE (Steinert) ET LA MYOTONIE CONGÉNITALE (Thomsen) EN SUISSE: D. Klein. Supplement, Vol. 7, *J. Genet. Hum. Ed.*, Medecine et Hygiene, Geneva, 1958. 328 pp.

Between 1945 and 1956, Dr. Klein collected 229 cases of dystrophia myotonica (Steinert) and 10 cases of myotonia congenita (Thomsen) in Switzerland. He has published the results of this investigation. The greatest part of his book is concerned with clinical and genealogical observations; this section is divided according to diagnosis and geographical origin of families. It is well illustrated, and the pedigrees charts are clear and well drawn.

With such a tremendous amount of data, the author gives a very accurate description of the clinical picture of the diseases under study and especially of cardiac disturbances in Steinert's disease. Dr. Klein confirms, on the whole, the description and conclusions reached by previous workers and asserts very firmly the clear-cut differences between the two types of myotonia. He thus finds himself in agreement with Curschman, Julia Bell, Penrose, Thomasen and Lynas.

However, we regret that the data are not also presented as a synthesis. In reading the text it is, for instance, very difficult to get an opinion on the mode of ascertainment, criteria of acceptance for the diagnosis, and on the signal symptoms.

The author does not discuss the biological features, but, judging from other papers, for instance Thomasen or Lynas, this point is probably of minor importance—at least in the classical approach to the problem.

Another point of interest is the endocrinological disorders in dystrophia myotonica. Testicular lesions are akin to those observed in the Klinefelter syndrome. Moreover, we know that the "Steinert's gene" may cause sexual reversion with male genitals but with feminine chromatin-nucleus pattern, at least in some cases, as pointed out by Grumbach and colleagues (*J. Clin. Endocrinol. Metab. 1957, **17**: 703*). It is difficult to ascertain the exact significance of this finding, but it could be of paramount importance, from a physiological "point de vue," for our comprehension of the genetics of sexual aberration. Indeed, the Steinert's gene is, as far as we know, the only well-defined one with such a property.

There is a slight prevalence of the disease in "males" in Dr. Klein's statistics. The difference is not significant but could be real since it is consistent with other data. When we pool Fleischer's, Maas's, Thomasen's de Jong's, Lynas's and Klein's, we find 456 males and 395 females ($p \simeq 0.5$). Julia Bell's series made of observations collected from the literature consists of 208 males and 141 females. It is likely that such a difference could be explained by case ascertainment. For instance, inability to work or sexual impotence could bring more males than females for examinations. But we also wonder if there is any connection between possible sexual reversion and this excess of males. At least, this hypothesis deserves, in our opinion, some consideration and could stimulate further work. We hope that Dr. Klein will offer some information on these interesting problems — something he has not undertaken here.

Dr. Klein gives very interesting and useful figures on fertility rate, age of

manifestation, age at death, and transmission of the disease according to the sex of affected parents. However valuable such an analysis may be, it seems to us that the interpretation could have been more sophisticated. For instance, we find nothing about maternal and paternal age. Probably, study of the latter would have been of great value according to Penrose's work (Parental age and mutation. *Lancet, 1957, ii :* 312), although the previous investigations of Thomasen and Lynas did not give any indication of such an effect. Unfortunately the presentation of the data does not permit their reexamination.

The expected anticipation appears from the data, the age of manifestation being 50.6 and 27.4, respectively, in parents and offspring. According to Dr. Klein's "impression," this result is real. However we would have preferred careful examination of the possible effects of selection and tests of the probable hypothesis of modifying genes in the form put down by L. S. Penrose or in alternative ones.

The mutation rate could also have been more thoroughly studied. For instance, we wonder why Dr. Klein makes use of Lynas's data for fitness but does not calculate a value from his own data, even if, as is probable, Lynas's is fairly accurate for the purpose.

Finally, we regret that he does not take advantage of such a survey to collect blood samples for linkage studies.

On the whole, Dr. Klein's book is a very good example of general surveys which are so urgently needed in human genetics but so difficult to achieve. We hope he will be able to give us some complementary data in the future, but as it stands, his book is certainly most valuable and every geneticist will read it with profit.

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Anomalies of Infants and Children: D. McCullagh and Wilson A. Swanker, McGraw-Hill Book Company, New York, 1958. pp. x, 454. 95 figures. $12.00.

Under the attractive title *Anomalies of Infants and Children* the authors, who practice surgery, have treated casually and superficially a variety of ills of children. The interest of the plastic or cosmetic surgeon is evident: there are more pages devoted to blepharoptosis (and even to thumbsucking) than to cardiac anomalies: more than 10 per cent of the book is devoted to burns and accidents. There are many bizarre notions expressed and some errors of fact; certain of the latter are downright dangerous, such as the statement on page 15 that ammonium or potassium chloride may be used to replace losses of sodium chloride following surgery (with their use in *isotonic* solution implied!). The authors' views of the importance of emotional factors surrounding defects in children are especially naive and unhelpful. I could find nothing in this volume to justify its high cost; it cannot be recommended.

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Periodical Reviews

GENETICS

A study of major congenital defects in Japanese infants. J. V. Neel, *The American Journal of Human Genetics,* **10** (1958), pp. 398-445.

In a thought-provoking paper, the author presents and discusses the implications of the results of a study on the major congenital defects occurring in Japanese infants. Upon comparing these data with those from other populations, he concludes that "even for any single, apparently specific congenital defect, there is undoubtedly a multiplicity of etiological pathways leading to that particular phenotype." He proposes that less than 10 per cent of all congenital defects occur because of the action of completely penetrant, dominant or recessive genes, and about 10 per cent are due to maternal illness, malnutrition, etc., during pregnancy. This leaves about 80 per cent that have to be accounted for. Since it is unlikely that this remaining number is due solely to dominant mutations, poorly penetrant dominant or recessive genes, unknown recessive genes, or other environmental effects, the author suggests that "a significant fraction of human congenital defects are the segregants (phenodeviants) resulting from the existence and functioning of complex (multi-local) genetic homeostatic systems, of the type particularly discussed by Lerner (1954, *Genetic Homeostasis,* New York: Wiley)."

This implies that a human population, through the action of mutation pressure and natural selection, builds up balanced polymorphic systems consisting of polygenes in the heterozygous condition which increase the probability of normal development. A congenital defect would then result when the proportion of loci needed in the heterozygote state to favor normal development falls below a given threshold. Differences in frequencies of specific congenital defects among different human populations would indicate that these populations have built up different homeostatic systems.

The author concludes that many of the congenital malformations may therefore be the price that populations pay for the selective advantage of the homeostatic system.

A recheck of Kindred 107, which has shown a high frequency of breast cancer. F. E. Stephens, *et al., Cancer,* **11** (1958), pp. 967-972.

Pedigree studies of breast cancer may be biased because of the way the pedigrees are ascertained, i.e., they are often selected for study because they show a high incidence of breast cancer. A compilation of pedigrees obtained in this manner can give a false impression of the etiological importance of heredity, because the frequency and distribution of cases within each pedigree could represent nothing more than a chance phenomenon. The cases within the same pedigree could have different etiological backgrounds.

In 1949, a survey was made of a Utah kindred showing a high frequency of breast cancer cases. The kindred was selected for study because it was reported to have a large number of breast cancer cases among its members. Nine

cases of breast cancer and four cases of breast tumors were found among the female members of certain branches of the kindred.

In order to determine whether these represented a chance combination of cases or the effect of a common genetic mechanism, the authors did a resurvey of the kindred nine years later. Eleven new cases of breast cancer and tumors of the breast were found in the same branches of the kindred that showed the high number of cases in 1949. One new case of breast cancer occurred in an 87-year-old man. The distribution of the new cases, in conjugation with the old cases, is difficult to explain on the basis of chance. The authors propose that even though the unusual distribution of cases may be influenced by chance, nevertheless, the data are compatible with the hypothesis of a simple Mendelian dominant trait with reduced penetrance in the males.

If such a gene is segregating in this kindred, then this represents a unique situation because statistical and twin studies and other pedigree studies suggest that "in most cases" heredity is only playing a minor etiological role for the disease. This suggests further that some malignancies of the breast, although similar clinically, may have vastly different etiological backgrounds.

Serum containing three Rh autohaemagglutinins. E. R. Gold, *et al., British Medical Journal,* No. 5107 (1958), pp. 1273-1274.

A patient suffering from chronic lymphatic leukemia and secondary hemalytic anemia was shown to have the Rh phenotype *CcDee.* His genotype was probably *CDe/cde.* The serum of this person was shown to contain the Rh antibodies, anti-*C,* anti-*D,* and anti-*e.* The patient had not received previous transfusions. Even though auto-antibodies have been demonstrated in a few other cases, this is the first report of an individual having three distinct Rh antibodies, each specific for an antigen produced by that individual.

Ueber einfache Rezessivität bei Mikrocephalia vera, spuria and combinata und das herdweise Vorkommen der Mikocephalia vera in Schweizer Isolaten. E. Hanhart, *Acta Geneticae Medicae et Gemellologiae,* 4 (1958), pp. 445-524.

The author presents the results of an extensive study of Microcephaly in Switzerland. He shows that in the great majority of cases, the evidence suggests that the condition is due to the homozygous condition of a single recessive gene. This appears to be the situation for *Microcephalia vera;* i.e., the classification when the trait occurs independently of any other disorder.

A total of 35 cases of *Microcephalia vera* was encountered in 23 sibships. Almost one-third of the patients originated from "isolates" in Switzerland. The sex ratio (17 males to 18 females) was practically 1 : 1. The frequency of the condition within the sibships, as shown by Weinberg's sib-method, was that expected for an autosomal recessive trait.

The parents of the propositi, known carriers for the recessive gene, could not be classified with any consistency, either physically or mentally. Since many patients are not interned and the death rate is high during early childhood, no attempt was made to obtain an accurate

frequency value of the trait in Switzerland. He proposes that the gene is semilethal and many affected individuals are removed from the population by spontaneous abortion.

Haemoglobin-H Disease. J. P. Bingle, *et al., British Medical Journal,* **5109** (1958), pp. 1389-1390.

Hemoglobin-H disease has been reported so far only in races that also have thalassemia minor and thalassemia major (Cooley's anemia). The clinical features of hemoglobin-H disease closely resemble those of thalassemia minor.

It has been suggested by at least one investigator that hemoglobin-H disease is due to an interaction between the gene for thalassemia and an "H" gene. The present authors present data on two families, each showing two cases of hemoglobin-H disease. Since thalassemia is not present in any of the members of either family, the authors conclude that these two diseases are independent.

The bearing of a complex-locus in Drosophila on the interpretation of the Rh series. E. A. Carlson. *The American Journal of Human Genetics,* **10** (1958), pp. 465-473.

The author proposes that advances in knowledge concerning complex loci in Drosophila and other organisms may resolve the controversy over the Rh series in man. Wiener states that the Rh series is best explained by a multiple allele system, while Fisher and Race favor an explanation based on closely linked genes. The debate over these two explanations is well recorded in the literature.

Mutations occurring at the dumpy locus in *Drosophila melanogaster* may cause a wing or thorax trait, may be homozygous lethal, or cause any combination of these characteristics. The mutant genes form a pseudoallelic series. Recombination tests have shown that there are at least seven mutable sites within the dumpy locus which are separable by crossing over. The complex locus occupies about 0.13 map units on the chromosome. The adjacent mutable sites have recombination frequencies varying from 0.01 per cent to 0.04 per cent.

The author proposes that the Rh series in man may be analogous to the dumpy series in Drosophila. If so, then the true explanation of the Rh series would differ from that proposed by Wiener or Fisher and Race. Using the *'CDE* nomenclature of Fisher and Race for mnemonic reasons, the author suggests that the various alleles of the Rh series could be symbolized by *'CDE, 'CDe, 'cDe,* etc., where the apostrophe represents some suitable base, such as rh. Each allele would represent a mutation at a different site within the Rh region on the chromosome.

This proposal differs from Wiener's because of the change in nomenclature and the pseudoallele concept. Even though it retains the *CDE* nomenclature of Fisher and Race, it differs from this hypothesis in interpretation, i.e., the allele *'CDE* would refer to a mutation at one site within the Rh locus and would not represent a combination of three separate loci.

Familial occurrence of congenital heart disease. R. A. Carlton, *et al., The New England Journal of Medicine,* **259** (1958), pp. 1237-1245.

A detailed report was made on 9 individuals with congenital heart disease

who belong to 3 different families. The total number of individuals in the 3 families was 113. All available and cooperative members were examined by the authors. There was no evidence of congenital heart disease in any of the other family members. The 9 cases were part of a larger number of congenital heart patients seen at the Heart Station of the Boston City Hospital. The authors conclude that the frequency of the disease in the families, 9 out of 113 (or 7.9 per cent), is much higher than that occurring in the general population, and is significant.

Three members (sibs) of one family all were shown to have a defect of the atrial septum. A child of one of these individuals was shown to possess a defect of the ventricular septum. In another family a defect of the atrial septum occurred in a parent and child.

The authors propose that the distribution of cases in the families is consistent with a recessive, autosomal mode of inheritance.

It is not clear how many of the 9 patients were ascertained independently. The manner by which the patients were selected for study would obviously influence any possible genetic interpretation. If the families were selected for study because they showed multiple cases of congenital heart disease, as is true for many families occurring in the literature, the true meaning of the given frequency value and the conjectured mode of inheritance are open to question. Although some family history studies found in the literature suggest a simple recessive mode of inheritance, others, based on a more random series of patients, suggest a more complex type of genetic mechanism or give little importance to such a mechanism.

On the inheritance of the Gm Serum Group. P. Lennett-Jepson, *et al., Acta Genetica et Statistica Medica,* **8** (1958), pp. 164-196.

During the year 1956, it was shown by several workers that the serum of some individuals, principally rheumatoid arthritis patients, would agglutinate Rh positive red cells of group O after the cells had been coated with certain "incomplete" Rh antibodies. It was then demonstrated in Sweden by Grubb and Laurell that the agglutination reaction can be inhibited by the serum of about 60 per cent of the Swedish people. The inhibiting phenomenon was shown to be hereditary and due to a dominant gene symbolized as Gm^a. *Its allele was symbolized as Gm.* Gm^aGm^a *or* Gm^aGm *genotypes give the phenotype Gm(a+), while GmGm gives the phenotype Gm(a—).*

By extensive family history studies and twin investigations, the authors have collected data supporting the hereditary nature of the new, unique Gm serum groups. From a study of 1,084 unrelated individuals in Denmark, they showed no significant difference between males and females for the phenotypes Gm (a+) and Gm (a—). The frequency of the gene Gm was estimated to be 0.666. The genotypic frequencies for Denmark consequently are: Gm^aGm^a: 0.1115, Gm^aGm: 0.4448, and GmGm: 0.4437.

Newly born infants have the Gm phenotype of their mothers, and it has not been determined yet at what age the child develops its own phenotype.

No correlation was found between the Gm serum groups and the ABO, MNS, Rh, P, Lewis, Kell, Lutheran or Duffy blood group systems, nor with the Hp group. The authors have emphasized

the possible importance of this new character in linkage studies, problems of genetic identity and relationship, disputed parentage, and genetical-anthropological research.

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POPULATION

The reproduction rate in Latin America: levels, differentials and trends. T. Lynn Smith. *Population Studies* 12, 1 (July 1958), 4-17.

Both the absence of data, particularly before 1950, and the poor quality of such data as exist, notably of birth registration figures, have made the study of reproduction in Latin America difficult and have contributed to the meagerness of present knowledge on this subject. A review of the problem leads the author to conclude that at the moment "there is little to be gained by an attempt to use any other gauge of the fertility of the population throughout Latin America" than the crude birth rate and the fertility ratio. Moreover, for many parts of the area even the crude birth rate is of little use so that resort to the fertility ratio becomes essential.

Granting the difficulties of analysis, the author proceeds to an exposition of such findings as the available data seem to yield. "Few definite conclusions may be drawn except that almost uniformly throughout Latin America the rate of reproduction is exceedingly high." There appears to be a pronounced excess of rural over urban fertility, the differential being greater where the general rate of reproduction is lower than where it is higher. Evidence from Brazil suggests the hypothesis that whites are outbreeding Negroes by a considerable margin; data from other countries do not support this hypothesis as generally applicable to Latin America as a whole, but neither do they support its converse. Though it is unlikely that the birth rate is rising in the region, it does not now appear to be significantly falling.

The considerable value of this article lies not only in its convenient summary of what is known about an important subject but also in the understanding it may give novices in the field of demographic analysis of the problems that arise in drawing meaningful conclusions from voluminous but poor statistics.

Seven years of a family planning program in three typical Japanese villages. Yoshio Koya and others. *Milbank Memorial Fund Quarterly* 34, 4 (October 1958), 363-372.

In 1949 the Population Council appointed by the Government of Japan recommended that the Government make possible family limitation by conception control rather than by abortion. To implement this policy, a study was undertaken in three villages that were considered typical to determine what methods of contraception would be acceptable and effective in Japan and how to disseminate instruction and supplies.

All of the somewhat more than 1,000 families in the villages were regularly visited by physicians, at least once a month during the early years of the study, and could obtain supplies from local midwives between visits. A wide variety of methods of contraception was explained and made available. Each family was encouraged to choose for itself, and to change methods if it wished to. The condom, with or without other

methods, proved to be the most popular, being used eventually by about half the couples who employed contraception.

Wide acceptance of contraception was observed. In the seventh year of the experiment the 1,325 families then in the study included 570 currently exposed to risk of pregnancy. Of these nearly 25 per cent wanted more children and 75 per cent were practicing contraception. Only three families fell into neither of these categories. During the seven years, the crude birth rate for the villages dropped from 26.7 to 13.6, while that for all Japan, in large measure as a result of abortion rather than contraception, fell from 33.0 to 18.4. The authors estimate that a country-wide contraception program comparable to that used in the study would have reduced the national number of births during the seven years by 3.7 million, or 4 per cent of the present population.

All readers who are concerned about the rapid rate of world population growth will find this article of interest. It is to be hoped that there will be further publications from this study giving information on costs, differences between the study villages and other parts of the population, and any special difficulties that were encountered.

Physiologic control of fertility: process and morality. William J. Gibbons, S.J., and Thomas K. Burch. *American Ecclesiastical Review* **138**, 4 (April 1958), 246-277.

The impending development of "methods of controlling fertility which secure their effect through the elimination or modification of physiological processes essential to reproduction, by administration of drugs, serums, and the like, and which therefore usually require no further interference with coitus immediately before, during, or immediately after its performance" raises important moral questions for Roman Catholics. In the view of the authors, it is probable that some persons will fail to see the distinctions involved and hence may believe such methods to be lawful in the eyes of the Church. Hence the need for a careful analysis of the subject.

The discussion begins with a summary of the underlying physiological bases for these forms of fertility control and an account of possible modifications of natural processes for control purposes. It is proposed that the various forms of physiological control "can appropriately be considered as either (a) sterilization [perhaps temporary or reversible], or (b) abortion or feticide." The relevant moral principles, it is asserted, do not deny that much research on fertility may be valuable and have acceptable applications, as in the treatment of disorders or the determination of the time of ovulation. However, the use of physiological control measures—and thus of sterilization, infanticide, or abortion—for the express purpose of preventing conception or destroying its product is not acceptable. Although "reasons can and do exist for regulation of offspring . . . not even legitimate ends may be sought by immoral means."

The authors conclude by pointing out that much remains to be said about certain of the concepts involved and note that "there is a large area of moral interrelationships which needs exploring at an early date, namely the impact of fertility upon economic life and social aspirations." It is the reviewer's be-

belief that students of population will be grateful for the present contribution to a clearer understanding of Roman Catholic thinking and will hope for an early extension of the authors' work into the important area to which they call attention.

West Indian immigration. G. C. L. Bertram. Eugenics Society Broadsheet No. 1. London: Eugenics Society, 1958. 24 pp., paper.

This is the first of a series of "broadsheets" that the Eugenics Society plans to issue in the hope of reaching a wider audience than normally reads the publications of the society. The purpose of the series will be "to review the whole position" on subjects with regard to which many people lack information, so that the reader's own conclusions "should at least be based on fact and not on mere emotion" (Preface). The initial publication is evidence of both the value and the difficulty of such a project.

The value appears in a condensed summary of what is known of the history of migration from the West Indies to the United Kingdom, the current size of the migration, the legal status of the migrants, and some of the social problems that have resulted from the movement. In recent years it appears that housing has been a serious problem, whereas employment has not. The fact that the British conception of family life is unfamiliar to many of the migrants is cited as one of the factors underlying the increasing proportions of individuals of Negro or mixed parentage among those in residential nurseries for illegitimate children. The present concern about racial mixture in the United Kingdom is seen as following upon the interruption of the evolution of isolated groups by the freer mobility introduced by modern transportation.

The difficulty of the broadsheet project appears especially in the sections on eugenic considerations and conclusions. Here a leading point is the "inconvenient lack of precise knowledge about the long-term implications of human genetic mixtures taking place in our times." Thus the goal of allowing the reader to base his judgment on fact is impeded by the absence of necessary information, even after he has read the material provided for him here. It is the author's opinion that interracial mating, though likely to increase, "seems to lead to more of trouble than of long-term happiness." The relative weight given to biological and social factors in forming this judgment is not altogether clear. In the proffered proposals for possible further action in the United Kingdom, including quality tests for immigrants and the imposition of a quota upon West Indians, there seem to the reviewer to be implied certain assumptions of political insularity that might well be made more explicit in the text.

The "younging" of electorates. Frank G. Dickinson. *Journal of the American Medical Association,* **166,** 9 (March 1, 1958), 1051-1057.

This discussion of one of the aspects of current population trends in Western nations has two principal components, a projection of the probable age structure of the voting population in the next two decades and a consideration of political effects that might result from the changes foreseen.

In the demographic analysis, five countries were investigated: Australia, New

Zealand, France, the United States, and Great Britain. According to the author's computations, the proportion of voters who are fifty years of age or older will reach a peak between 1961 and 1970 in the first four of these countries. In Great Britain the proportion will still be rising as late as 1978. Fertility, mortality, and migration are all involved in the complex of events that will produce a peak proportion of older voters about 15 per cent above the 1910 proportion.

For an understanding of the implications of the changing age structure of the electorate, the author interviewed some five dozen "mature leaders" in Australia and another dozen in New Zealand. Among those polled, political leaders and the clergy contributed more valuably than economists, historians, and political scientists. Major attention was given to the effect of the proportion of older voters on the kind and amount of social legislation. While recognizing that many factors are involved, the author suggests that the aging of the electorate has speeded and the younging of the electorate will slow down the trend toward the "welfare state." It appears that the author observes this potential reversal with satisfaction.

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